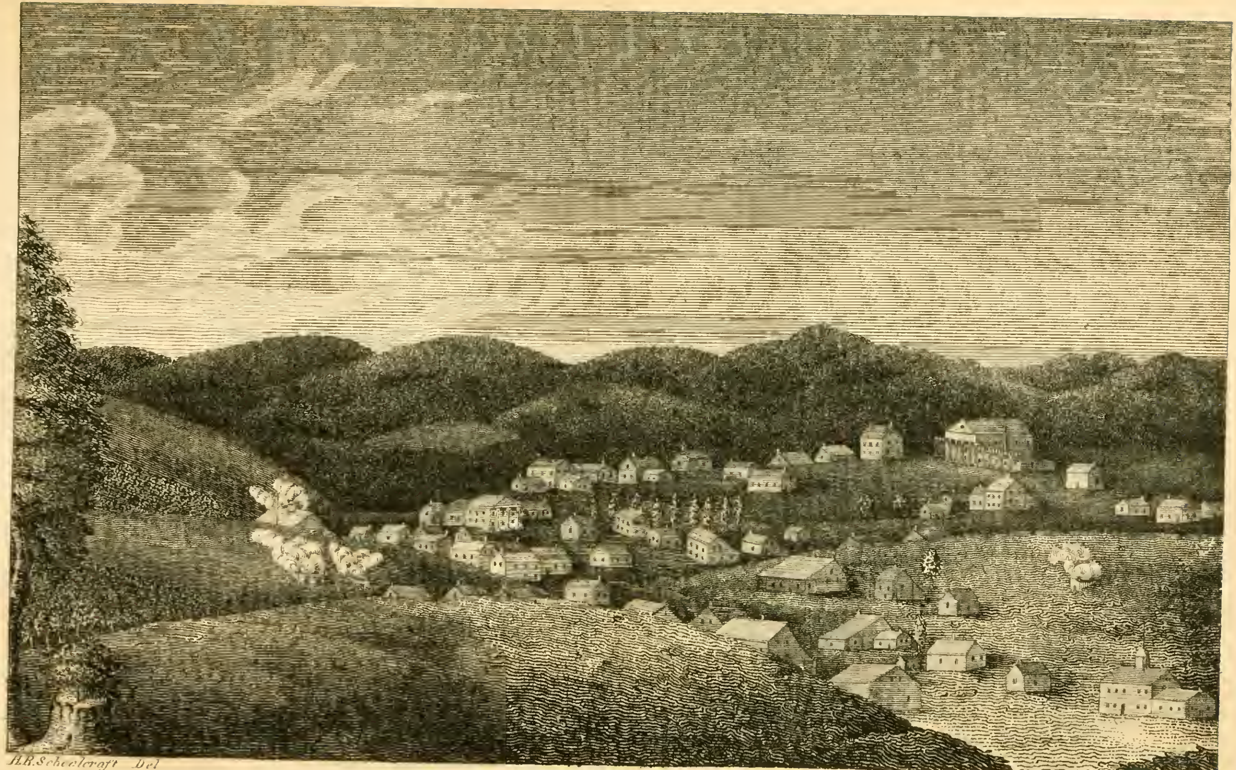

H.R. Schoolcraft Del

J.D. Stout Sc. N. York.

POTOSI

alias Mine à Burton.

A VIEW

OF THE

LEAD MINES OF MISSOURI;

INCLUDING

SOME OBSERVATIONS

ON THE

MINERALOGY, GEOLOGY, GEOGRAPHY,

ANTIQUITIES, SOIL, CLIMATE, POPULATION,

AND PRODUCTIONS

OF

MISSOURI AND ARKANSAW,

AND

OTHER SECTIONS OF THE WESTERN COUNTRY.

ACCOMPANIED BY THREE ENGRAVINGS

BY HENRY R. SCHOOLCRAFT,

CORRESPONDING MEMBER OF THE LYCEUM OF NATURAL HISTORY OF NEW-YORK.

NEW-YORK:

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Southern District of New-York, ss.

BE IT REMEMBERED, That on the twenty-seventh day of November, in the forty-fourth year of the Independence of the United States of America, HENRY R. SCHOOLCRAFT, of the said District, hath deposited in this Office the title of a Book, the right whereof he claims as Author, in the words following, to wit:—

" A View of the Lead Mines of Missouri; including some observations on the Mineralogy, Geology, Geography, Antiquities, Soil, Climate, Population, and Productions of Missouri and Arkansaw, and other sections of the Western Country. Accompanied by three Engravings. By Henry R. Schoolcraft, corresponding member of the Lyceum of Natural History of New-York."

In conformity to the Act of the Congress of the United States, entitled " An Act for the encouragement of Learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the time therein mentioned." And also to an Act, entitled " an Act, supplementary to an Act, entitled an Act for the encouragement of Learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the times therein mentioned, and extending the benefits thereof to the arts of designing, engraving, and etching historical and other prints."

GILBERT LIVINGSTON THOMPSON,
Clerk of the Southern District of New-York

TO

JOHN G. BOGERT, ESQ.

MEMBER OF THE ANTIQUARIAN SOCIETY OF MASSACHUSETTS;

OF THE

LITERARY AND PHILOSOPHICAL, AND OF THE HISTORICAL SOCIETY OF

NEW-YORK;

RUSSIAN CONSUL FOR THE STATES OF NEW-YORK, CONNECTICUT AND

NEW-JERSEY, &c.

THIS WORK IS RESPECTFULLY INSCRIBED

BY THE AUTHOR,

IN TESTIMONY OF ESTEEM FOR HIS

CHARACTER

AS A CITIZEN, AND A FRIEND;

AND AS

A TRIBUTE OF RESPECT

FOR HIS ZEAL IN THE PROMOTION OF

NATURAL SCIENCES;

ESPECIALLY

MINERALOGY, CONCHOLOGY,

AND THE COLLECTION OF THE

EXTRANEOUS FOSSILS OF THE UNITED STATES

OF AMERICA.

PREFACE.

When we reflect upon the history of our own country,—the rapidity with which its natural resources have been developed,—its attainments in the arts of civilized life, in commerce, and in agriculture,—its increase in population, and the progress of its settlement, the mind is with difficulty brought to believe that scarcely two centuries have elapsed, since it was the unmolested seat of barbarity, and intellectual night. But whatever may have been our advances in civil refinement, mechanical, and polite arts, useful inventions, public works, agriculture, jurisprudence, naval architecture, the endowment of literary institutions, and other momentous objects, evincing a matured state of society, yet, in no respect is our national growth so apparent, as in the increased population, and the astonishing progress of the settlement of our country. A new world has recently been discovered within the bosom of our land, and the region west of the Alleghany Mountain, is already the seat of legislation, and the arts of civilized life. So rapid has been the emigration into that section of the Union, and so sudden its transformation from barbarism to refinement, that it seems rather the effect of magical power, than of human exertions, operating in the ordinary way. No sooner had the fertility of the soil in that region become known, and the advantages it presented to the industrious and the enterprising of all classes, than a universal desire for emigration was manifested, and information concerning it was sought after with the utmost avidity. But the first travellers who passed down the valley of the Mississippi, did little more than glance at the varied and extensive country, bordering that stream. A general outline of its geographical features,—of its soil and climate,—of its extent and resources was, however, given, with many interesting particulars concerning its antiquities, and physical productions; but the detail has been left as the subject of succeeding inquiry and remark. Much of the information published at an early day, being founded on an imperfect acquaintance with the country, has proved fallacious, other facts of moment have since been disclosed by the progress of settlement, and notwithstanding the appearance of several works of merit concerning that country, a wide field is still left for observation and research, both to the

man of business, and the man of science, and an increased desire is manifested for further information. The period has in fact already arrived, when men begin to seek for scientific and elementary information on the various subjects connected with the vegetable, animal, and mineral resources of that country,—with its soil and climate—its streams and mountains—its towns and settlements—its mines and minerals—its trees and plants—its antiquities and reliqua—its birds—fishes—insects—reptiles—animals, living and extinct—the fossils imbedded in the earth—the physical constitution of its rocks and soils, and the changes which they have undergone from heat, air, water, light, attrition, and other constantly operating and powerful causes—the temperature of the atmosphere—the course of the winds—the diseases prevalent—its natural phenomenon, and other matters, equally concerning the learned, and the unlearned. On some of these heads, we are already in the possession of much valuable information ; on many of them nothing has been written, and all present subjects for consideration, replete with the highest interest, and intimately connected with the wants, comforts, happiness, and security of ourselves and our posterity. The soil, climate, population, and agricultural advantages of the western country, have been the subject of frequent description, and several meritorious works have been published concerning it. Jefferson, Volney, Breckenridge, Darby, and Evans, have successively added to our stock of useful knowledge, and contributed largely to perfect and extend the sphere of our acquaintance with the moral, physical, and political condition of that country, particularly with regard to its topography, statistics, antiquities, and commercial resources. But its mineralogy remains almost wholly unnoticed, and we look in vain, either for a general outline of its mineralogical character, or a description of its mines. Travellers seem to have hastened with so eager a pace, in the exploration of its fertile fields and extensive prairies, and to have been so completely absorbed in the contemplation of its bold geographical outlines, and the interminable length of its rivers, that they have entirely overlooked the humble, but not less attractive minerals, by which it is so strongly characterized. The mines of Missouri, especially, have failed to attract the consideration which they merit.—Breckenridge has, indeed, given us some interesting details on the subject ; but the value of what he has written, is not uniform ; much of the information given, is

vague or hypothetical, and upon the whole, he stops short of the desired point. Schultz wrote nothing of value on the subject. Austin's pamphlet was the most valuable document of its time, but being written for a specific purpose, is not sufficiently diffuse in regard to the situation and extent of the mines, method of working, &c. Stoddart, too much inclined to credulity, did not always write from personal observation, and many of his conclusions are drawn from assumed premises. We are, therefore, still in want of a detailed account of the mines, the extent and quality of the ore, the character of the accompanying minerals, the methods of mining, the nature of the contiguous country, its character, value, population, and resources, its advantages for water-mills and manufactories, the facilities it affords by its streams for internal navigation, with other facts necessary in estimating the collective value and importance of those mines. A want of information is also felt in regard to the physical history of the western country, particularly its minerals, fossils, geology, antiquities, &c. To supply this deficiency, I have written the following work, in which I have endeavoured to present a condensed body of facts in a small compass, and in a plain way, omitting the introduction of technical phraseology, in all instances where it was consistent with the utility or perspicuity of description.

What I have written on these subjects, is the result of personal observation, during a tour through the states and territories west of the Alleghany Mountains, performed in the years 1818 and 1819, including a year's residence in Missouri Territory. In passing down the valley of the Mississippi, I embraced every opportunity to acquire a knowledge of the mineralogical character of the country, and have been enabled to form a considerable collection of ores, spars, fossils, &c. illustrative of its physical geography, and natural resourses. A catalogue of these will be found in the ensuing pages. To acquire information on the subject of the mines, I visited them, and fixed my residence there. I have made a personal examination of every mine of consequence, with a view to ascertain its general character and value, and its peculiarities. I have travelled on foot over the whole mine country, exploring its minerals, its geological structure, its geographical position, soil, climate, productions, towns, streams, settlements, and whatever else appeared to me to be necessary to describe,

explain, and illustrate the subject before me. If, therefore, I have failed to collect a body of facts worthy public approbation, it can neither be attributed to a want of industry, or a want of opportunity.

The historical facts recorded respecting Renault's operations, have never before appeared in print. They were elicited in the course of a legal investigation, recently instituted between the heirs at law of Renault and sundry individuals, who claimed the lands in Missouri and Illinois, granted to him, A. D. 1723, in consideration of his services. During these inquiries, many facts hitherto unknown respecting the early history of Louisiana, were brought to light; and some new matter has been drawn from the obscurity of private life, both in France and America, which completely developes the views, and transactions of that day. Of this information, I have been presented with an opportunity to avail myself, through the friendship and politeness of those persons, in whose possession the original papers, documents, and certificates remain.

The drawings I give of the lead furnaces, are from actual measurement, done under the eye, and corrected by an operative builder of approved skill at Potosi, and are conceived to be minutely correct.

HENRY R. SCHOOLCRAFT.

New-York, 25th Nov. 1819.

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A VIEW OF THE LEAD MINES OF MISSOURI.

SECTION I.

Historical Sketch of the Mines.

The rage for adventures, which the brilliant exploits of Pizarro, Cortez, and other Spanish adventurers, had excited throughout Europe, continued for a long time to agitate the public mind; and had not abated at the commencement of the eighteenth century, when an idea of the mineral riches of Louisiana had become prevalent. Gold and silver were then the chief objects which engrossed attention; and in search of them, the earliest discoverers were led to penetrate into the interior. The physical aspect of the country was in general such as to flatter the most sanguine expectations of mineral wealth; and the further the country became known, the more interesting was found its mineralogical character. To men whose pre-conceived ideas of a country were already high, such appearances must have had the most inspiriting effect, and lightened the embarrassments they encountered in exploring a wilderness. Many of the useful metals were thus met with, and gold and silver mines were reported to have been discovered in several places. Red

River, the Arkansaw, and the river La Platte of the Missouri, were particularly mentioned; and from the evidence which is daily afforded by the discovery of ancient furnaces, &c. there is reason to conclude that those metals were wrought at a very early period, and that bodies of the ore still exist. Judging from what was found, they were ready to conclude the country exhaustless in mines; and the most exaggerated accounts of them appear to have been transmitted to Europe, particularly to France, where a lively interest was felt in the prosperity of the infant colonies in Louisiana and Illinois; and in the descriptions published at that day, the lands are reputed to equal in fertility the banks of the Nile, and the mountains to vie with the wealth of Peru.

It was in this supposition of the immense wealth of Louisiana, both in the vegetable and mineral kingdoms, that the renowned Mississippi scheme originated, and which, from the imposing character it was made to assume under the guidance and direction of M. Law, drew upon it the eyes, not only of France, but of all Europe, and produced one of the most memorable disappointments recorded in the annals of commercial speculation.

Louis XIV, by letters patent, bearing date September 14th, A.D. 1712, granted to Anthony Crozat, Counsellor of State, Secretary of the Household, &c. the exclusive privilege of commerce of that district of country, now known as the States of Louisiana, Mississippi, Tennessee, and Illinois, and the Territories of Missouri and Arkansaw.

with the propriety of the mines and minerals he should discover in the country, reserving the fifth part of all bullion of gold and silver, and the one-tenth of the produce of all other mines. The exclusive privilege of commerce was granted for a term of fifteen years; but the propriety of the mines was conveyed in perpetuity to him and his heirs, on the condition that such mines and minerals should revert back to the crown of France, whenever the working of them was discontinued for three years together. The bounds of Louisiana, as granted to Crozat, are described in these words:—"Bounded by New Mexico, (on the west,) and by the lands of the English of Carolina, (on the east,) including all the establishments, ports, havens, rivers, and principally the port and haven of the Isle of Dauphine, heretofore called Massaerè; the river of St. Louis, heretofore called Mississippi, from the edge of the sea as far as the Illinois, together with the river of St. Philip, heretofore called Ouabache, (Wabash,) with all the countries, territories, lakes within land, and the rivers which fall directly or indirectly into that part of the river of St. Louis."

In the month of August, A. D. 1717, M. Crozat solicited permission to retrocede to the crown his privilege of the exclusive commerce and the mines of Louisiana, which was granted by an arret of the Council of State, during the minority of Louis XV. In the same month, letters patent were granted by the Council of the Regency to an association of individuals at Paris, under the name of The Company of the West, by which they were

invested with the exclusive privilege of the commerce of Louisiana, and the working of the mines, to the same extent as it was enjoyed under the grant of Crozat. These letters patent were dated on the 23d of August, A. D. 1717, registered 6th September, of the same year, and were to be in force on the 1st of January, 1718, and to continue for a period of 25 years. By them, not only such grants and privileges were conveyed as had previously been enjoyed by Crozat, but they were invested with additional powers, rights, and privileges. The territory was granted in free allodium, (*en franc allieu,*) in lordship and in justice, the crown reserving to itself no other rights or duties but those of fealty and liege homage, which the Company was required to pay to the King, and to his successors at each mutation of kings, with a crown of gold of the weight of thirty marks. The boundaries were the same as described in the grant to Crozat, and the mines and mining grounds, opened or discovered during the term of its privilege, were declared to belong to the Company incommutably, without being holden to pay any rents or proceeds whatever. The Company was also invested with the right to sell and alienate the lands of its concession, at whatever price or rents they might fix, and even to grant them *en franc allieu,* without reserving the rights of justice or lordship. It was also provided that if, after the expiration of 25 years, for which the exclusive privilege of commerce was granted, the King should not see proper to continue the privilege by a new grant, all the lands and islands, mines, and mining grounds, which

The Company of the West should have inhabited, worked, improved, or disposed of on rent, or any valuable consideration whatever, should remain to it for ever in fee simple, to use and dispose of as a proper inheritance, on the simple condition, that the Company should never sell such lands to any other than the subjects of France.

A Company, incorporated with such ample rights and privileges, did not fail to draw upon it the attention of the speculative, or to enlist the aid of the enterprising capitalists of the French metropolis. The country of the Illinois was reputed rich beyond comparison: the financial estimates submitted to the view of the public, offered prospects of unusual gain, and capitalists flocked with avidity from all quarters, to enrol themselves as members of the Company, and partake of the promised wealth. If any thing had been wanting to accelerate the pace of adventurers, or to fan the ardour of hope, it was the genius, the financial abilities, and the commanding influence of M. Law, who was placed at the head of the Company, and was the moving power in every transaction. Men have been nearly alike in all ages. The Grecians are characterized for manly integrity and submission to the laws; the Romans are renowned for for their bravery in war and their refinements in the arts of civilized life; the English for their acquirements in science and literature; the Americans for the equality of their laws: but in matters of interest, they are all alike, and when money is the object of pursuit, we forget every local distinction of language and country, in the similarity

of sentiment which actuates them, their hopes of success, and the uniform means which are taken to acquire a similar object. Nor do men always, when a scheme of sudden wealth or aggrandizement is presented, duly consider the chances of success, in opposition to the probabilities of a failure. Hence it is no subject for surprise, that the most extravagant anticipations were entertained by the members of The Company of the West, or that the unusual splendour of the Mississippi scheme was only equalled by the signal disappointment in which it eventuated.

In the year after The Company of the West had been instituted by the royal patent of the King, they formed an establishment in the country of the Illinois at Fort Chartrès; and in order to promote the objects of their institution, and to encourage the settlement of the country, held out the most liberal inducements to French emigrants, and made them donations of all lands which they should cultivate or improve. Miners and mechanics were also encouraged to emigrate, and the city of New-Orleans, which had been founded during the last year of the authority of Crozat, (1717,) received a considerable accession to its population in the fall of the same year, and settlements began to extend along the banks of the Mississippi, and in the country of the Illinois. Among the number of adventurers to Illinois, was Philip Francis Renault, (the son of Philip Renault, a noted iron-founder at Consobre, near to Mauberge, in France,) who came over as the agent of the Company of St. Philips, an association of individuals which had been

formed under the patronage of the western company, for prosecuting the mining business in the upper country of Louisiana and Illinois. It appears also that he was a member of the Company of the West, and he is spoken of as *Director General of the Mines of the Royal India Company in Illinois;* a name by which not only the present state of Illinois, but a vast district of the adjoining country, appears then to have been known.

Renault left France in the year 1719, with two hundred artificers and miners, provided with tools, and whatever else was necessary for carrying the objects of the company into effect. In his passage he touched at the Island of St. Domingo, and purchased five hundred slaves for working the mines; and entering the Mississippi pursued his voyage up that river to New Orleans, which he reached some time in the year 1720, and soon afterwards proceeded on his way to Kaskaskia, in Illinois. Kaskaskia was then inhabited solely by the French, and was one of the earliest posts occupied by them when they began to extend their posts from Canada along the great western Lakes, and down the Ohio and Mississippi. Renault established himself in the vicinity of this town, near Fort Chartrès, at a spot which he named St. Phillips, (now called the *Little Village*,) and from this sent out his mining and exploring parties into various sections of Illinois and Louisiana. These parties were either headed by himself, or M. La Motte, an agent versed in the knowledge of minerals, whom he had brought over with him. In one of the earliest of these excursions La Motte

discovered the lead mines on St. Francis, which bear his name; and at a subsequent period Renault made a discovery of those extensive mines north of Potosi, which continue to be called after the discoverer. Other mines of lead were also found, but their distinctive appellations have not survived; and a proof of the diligence with which Renault prosecuted the object, is furnished by the number and extent of the old diggings which are now found in various parts of the country. These diggings are scattered over the whole mine country, and hardly a season passes, in which some antique works, overgrown with brush and trees, are not found.

Renault being probably disappointed in the high expectations he had formed of finding gold and silver, turned his whole force towards the smelting of lead, and there is reason to conclude, that very great quantities were made. It was conveyed from the interior on pack-horses, (the only mode of transportation which was practicable at that early period.) The lead made by Renault was sent to New Orleans, and from thence chiefly shipped for France. That he also discovered copper is beyond a doubt, and a grant of land made to him at *Old Piora*, on the Illinois river, embraces a copper mine.

Renault's operations were, however, retarded and checked, from a quarter were it was least expected. By an edict of the king, made at Paris in May, 1719, the Company of the West was united to the East India and Chinese company, under the title of the Company Royal of the Indies; (*La*

Compagnie Royale des Indies.) And in 1731, the whole territory was retroceded to the crown of France, the objects of the company having totally failed; and Renault was left in America, without the means of prosecuting the mining business. His exertions in behalf of the company were not, however, overlooked by the government, and four several grants of land were made to him in consideration of his services. These grants bear date June 14th, A. D. 1723, and cover the *Mine La Motte*, and some other very valuable tracts, which, after having laid dormant for a period of about sixty years, have recently been claimed by the representatives of his heirs at law.

Renault, however, remained in Illinois several years after the explosion of the Mississippi scheme, and did not return to his native country until A. D. 1742. With him the greater part of his workmen returned; the slaves were sold, and the mining business fell into neglect. Here is a period to the first attempt at mining in Louisiana.

After Renault's departure, little or nothing appears to have been done in the way of mining, and even after the Spanish had acquired possession of the country*, the lead mines were but little attended to. The force which Renault had with him was sufficient to protect him from the attacks of the savages; but after his departure, the settlements on the Mississippi, feeble in themselves, could not furnish protection to such as might be

* Louisiana was ceded to Spain by France A. D. 1762, and taken possession of by Spain, 1769.

disposed to work at the mines. The Spanish, however, in a few years after taking possession of the country, did something, and in process of time new discoveries were made, and the mining business began to assume a more respectable character. The principal discovery made under the Spanish authority was, *Mine à Burton*, which takes its name from a person of the name of Burton*, who being out on a hunt in that quarter, found the ore lying on the surface of the ground. This man, who is now still living in the vicinity of St. Genevieve, at the advanced age of one hundred and nine years, had been employed while a youth under Renault. The period of this discovery it would be very difficult now to ascertain, Burton

* The following sketch of the life of Burton is given by Colonel Thomas H. Benton, of St. Louis. "He is a Frenchman, from the north of France. In the forepart of the last century, he served in the low countries under the orders of Marschal Saxe. He was at Fontenoy when the duke of Cumberland was beat there by that Marschal. He was at the seige of *Bergen-op-Zoom*, and assisted in the assault of that place when it was assailed by a division of Marschal Saxe's army, under the command of Count Lowendahl. He has also seen service upon the continent. He was at the building of Fort Chartrès on the American bottom, afterwards went to Fort Du Quesne, (now Pittsburgh) and was present at Braddock's defeat. From the life of a soldier, Burton passed to that of a hunter, and in this character, about half a century ago, while pursuing a bear to the west of the Mississippi, he discovered the rich lead mines which have borne his name ever since. His present age cannot be ascertained. He was certainly an *old soldier* at Fort Chartrès, when some of the people of the present day were little children at that place. The most moderate computation will make him an hundred and six. He now lives in the family of Mr. Micheaux at the little rock ferry, three miles above St. Genevieve, and walks to that village almost every Sunday to attend mass. He is what we call a square built man, of five feet eight inches high, full chest and forehead; his sense of seeing and hearing somewhat impaired, but free from disease, and apparently able to hold out against time for many years to come." [*St. Louis Enquirer, October* 16, 1818.]

himself being unable to fix it. It has been known about *forty years.* (1819.)

The processes of mining pursued under the Spanish government, appear to have been very rude and imperfect, not more than fifty per cent. of lead being got from the ore. The common *Open Log Furnace* was the only one employed, and the *lead-ashes* were thrown by as useless. Neither was shot, or any other manufacture of it, attempted by native Spaniards.

In A. D. 1797, Moses Austin, Esq. performed a journey from the lead mines in Weythe County, Virginia, to the Mine à Burton, in Louisiana, and obtained a grant of land of one league square, from the Spanish authorities, in consideration of erecting a reverberatory furnace, and other works, for prosecuting the mining business at those mines. This he commenced A. D. 1798, and previous to that time no furnace for smelting the *ashes of lead*, made in the Log Furnace, had been erected. Mr. Austin sunk the first regular shaft for raising the ore, and introduced some other improvements which were found beneficial.

He also, A. D. 1799, erected a shot tower, under the superintendance of Mr. Elias Bates, and patent shot of an approved quality were made. A manufactory of sheet lead was completed during the same year, and the Spanish arsenals at New-Orleans, and Havanna, drew a considerable part of the supplies for their navy from this source.

About this time a few other American families crossed over into Louisiana territory, and settled in the neighbourhood of the mines. These, from

their more enlightened views, and enterprising spirit, were certainly an acquisition to the mining interest, and as their earliest attention was directed to this, the lead business began to revive; and at the time the territory was taken possession of by the United States, were pretty extensively and advantageously worked*. The *Mine á Robino*, *Mine á Martin*, and many others were shortly afterwards discovered; and since the year 1804, the number of mines has been astonishingly multiplied; *Shibboleth*, *New Diggings*, *Lebaum's*, and *Bryan's* mines, are among the latest discoveries of consequence.

The lead mines did not fail to attract the earliest attention of the American government, and immediately after the occupation of the territory by General Wilkinson, measures were taken to ascertain the situation and extent of the mines; the method of working them; with their annual produce, and such other information as was necessary in forming an idea of their importance. Several laws have since been enacted on the subject, and a reservation made of all discoveries upon public lands.

The emigration to Louisiana, which had partially commenced under the Spanish government, took a more decided character after the

* The following is a list of the principal mines worked under the Spanish overnment:

Mines.	*Situation.*
Mine La Motte, - - -	Head of St. Francis River.
Mine à Joe, - - - -	on Flat River.
Mine à Burton, - - -	on a branch of Mineral Fork.
Old Mines, - - - -	do. do.
Renault's Mines, - - -	on Mineral Fork, or Fouche Arno.

cession of the country to the United States; but has been particularly great within the last few years.

In 1812 that part of Louisiana bordering on the Gulph of Mexico, including New-Orleans, and extending up the Mississippi to the 33° of north latitude, was erected into a state under the name of Louisiana, and the remainder formed into a Territorial Government by the name of Missouri. There is a petition now before Congress (Feb. 1819) for the admission of Missouri into the Union on a footing with the original states. By this petition it is contemplated that *White River* will form the southern boundary, and the country between that and the northern line of Louisiana, including our claims on the Spanish, will be erected into a Territorial Government under the the name of Arkansaw*.

Respecting the present state of the lead mines, it is only necessary here to add, that they are worked in a more improved manner than at any former period; that they are more extensive than when the country came into the hands of the United States, and of course giving employment to a greater number of miners, while every season is adding to the number of mines; and that the ores may be considered of the richest kind. Every day is developing to us the vast resources of this country in minerals, and particularly in lead; and we cannot resist the belief that in riches and extent, the mines of Missouri are paralleled by no other

* A law erecting the Territory of Arkansaw from the southern part of Missouri, has since past, but its northern boundary is extended so as to include all White River, and the principal part of Lawrence county.

mineral district in the world. In the working of the mines—in raising the ore, and smelting it,—and in the establishment of the different manufactures dependent upon it, there is much to be done. Though the processes now pursued are greatly superior to those in use under the French and Spanish governments, there is still ample room for improvement. The earth has not yet been penetrated over 80 feet! we know not what may be found in the lower strata of the soil. There is reason to believe that the main bodies of ore have not yet been hit upon, that they lie *deeper*, and that we have thus far only been engaged upon the spurs and detached masses. There is also reason to believe that large bodies of the ores of Zinc, exist in the district of the mines; and that Copper will be afforded by the lower strata of earth. It is found overlaid by lead ores in many of the European mines, and the geognostic character of the country leads us to conclude it may also be found here.

The want of capitalists in the mine country—of scientific knowledge in those by whom mining is conducted, and of practical skill in the boring, blasting, sinking shafts, and galleries, draining and ventilating—these oppose obstacles to the successful progress of mining. There is but one regular hearth furnace for smelting in the whole district. and that is not on the modern plan of English furnaces. There are not over four or five regular shafts out of about 40 mines,—there is not an engine either by horse, steam, or water power, for removing water from the mines, several of which

have been abandoned on this account with the richest prospects of ore in view. In fine, there is little of that system, skill, industry, and precaution, which characterize the best conducted European mines, and which, by an application of the most recent discoveries in mechanics, chymistry and philosophy, render them the admiration of every intelligent visiter. By and by, it may attract the attention of some mining capitalists of Great Britain and other parts, and such a circumstance would form a new era in the history of the mining operations of this country. Something also remains to be done by the government, the existing laws are inadequate to the purposes for which they were enacted. That feature restricting leases to *three* years is injudicious; the period is so short that it deters those who are most able, from engaging in it at all. It is also desirable that such a system should be established, as would enable us to get at the annual produce of the mines, number of hands employed, and such other facts as are necessary in forming a series of statistical tables on the subject. The want of such data has hitherto prevented us from setting a true value upon the mines, and of properly estimating their importance in a national point of view. The acquisition of a scientific knowledge of minerals should also be facilitated by the establishment of a seminary in this quarter. There should be a mineralogical school located in the mine country, where students might be instructed in that useful science. In a country so rich in minerals and fossils, and whose wealth will always so much depend upon a proper developement of these resources,

the knowledge of minerals should be laid open to every one. and it should be within the reach of such as do not wish, or cannot get the other branches of a liberal education. To obtain this knowledge now, even were there a prevelent taste for it, a person would be compelled to travel to remote parts of the union, and to incur an unreasonable expense. No one who is conversant with the advantages which various parts of Germany, and particularly Saxony, has derived from such a seminary, will deny the utility of a similar one in the United States; and as to its location there can be no question, for, compared with any other section of the union, this will be found *the land of ores—the country of minerals.*

Yet with all the disadvantages under which the lead mines have been viewed, and others which it would be superfluous to detail, there are many who may be surprised to find their annual products (from the best information) stated at *three millions of pounds:* and from this some idea may be formed of their vast riches and extent, and, when they come to be properly and regularly worked, how greatly they will contribute towards our wealth and independence.

The following are the principal Historical Epochs of Louisiana, chronologically arranged.

Discovered by Ferdinand de Soto, and named Florida,	A. D.	1539
Visited by the French from Canada	,,	1674
Settlement made by La Salle	,,	1683
A settlement made at Bolixi	,,	1699
Granted to Crozat by Louis XIV. 14th Sept.	,,	1712
New-Orleans founded by the French	,,	1717
Retroceded to the crown by Crozat	,,	,,
Granted to the Company of the West	,,	,,
Retroceded by the Company of the West	,,	1731
Ceded to Spain by France	,,	1762
First occupied by the Spanish	,,	1769
Ceded to the United States	,,	1803
Taken possession of by the U. S. 20 Dec.	,,	,,
Louisiana became a State, August	,,	1812
Missouri Territory erected, 4th June	,,	1812
Territory of Arkansaw erected, March	,,	1819

SECTION II.

General Outline of the Mine Country.

The district of country which is characterized by affording lead ore, and formerly known as the *lead mines of Louisiana*, comprises the present counties of Washington, St. Genevieve, Jefferson, and Madison: Missouri Territory. It extends in length from the head waters of the St. Francis, in a northwest direction, to the Merrimack, a distance of 70 miles; and in breadth from the Mississippi in a southwest direction to the Fourche à Courtois, a distance of about 45 miles, and covering an area of 3150 square miles.

This tract is generally characterized by yielding lead ores, and is the seat of such mines as now are, or have formerly been wrought. It is not on every particular section of it that the existence of lead is to be traced, nor is the mineral character of the soil, rocks, and other earthy and stony bodies uniformly preserved. And, on the contrary, there is no considerable tract, on which ore is not to be found. The general aspect of the country is sterile, though not mountainous: the lands lie *rolling*, like a body of water in gentle agitation. In some places the hills rise into abrupt cliffs, where the great rock formations of the country may be seen; in others, they run into level plains: a kind of highland *prairie*. The soil is a reddish coloured clay, stiff and hard, and full of fragments of flinty stone, quartz, and gravel: this extends to the

depth of from 10 to 20 feet, and is bottomed on limestone rock. It is so compact in some places as almost to resist the pickaxe; in others, it seems to partake of marl, is less gravelly, and readily penetrated. The country is particularly characterized by quartz, which is strewed in detached pieces over the surface of the ground, and is also found imbedded in the soil at all depths. This is here called *blossom of lead*. Iron ores, and pyrites are also scattered over the surface of the ground, and occasionally lead ore. Such is the general character of the mineral hills, which are invariably covered by a stinted growth of oaks, and what are here denominated *post oaks*. They are seldom found to grow higher than 30 feet, and 40 is the highest, seldom exceed a foot in diameter, and stand scattering. In some places walnut is found; and there is a ridge of yellow pine running the whole extent of the mine tract, from the St. Francis to the Merrimack, but it is not more than six or eight miles wide, and no discovery of lead has been made upon it,—at least, no quantity has been found. The mines lie generally east of it. This ridge of pine traverses the country in a general course from S. E. to N. W. a fact which may also be observed in regard to the veins of lead, viewed in connexion with each other, and as they are to be traced from mine to mine. The hills also yield sassafras, and the slopes which are richer soil, afford buckeye, black walnut, papaw, and percimmon, and some other trees, shrubs, and wild fruits; and the whole is covered in summer by a luxuriant growth of grass, even the poorest hills,

which hides the flinty aspect of the country, and gives it a very pleasing and picturesque appearance.

The vallies have always a stratum of alluvial soil, which is more or less deep, according to their extent, but there are few which are not adapted for cultivation, and the *bottoms* on the streams, and lowland *prairies*, consist of several strata of black alluvial earth, affording some of the richest farming lands in the western country. The strong quality of the soil is shown in the heavy growth of trees with which it is covered. The principal of these are sycamore, elm, cotton wood, oaks, walnut, maple, buckeye, hackberry, ash, papaw, percimmon, spicewood, mulberry, sassafras, and dogwood. A rank growth of vines and shrubs also overruns the bottom land; and in no other country is there to be found so great a variety and abundance of wild fruits; of these, the following is a catalogue:

Grape,	Hackberry,
Red plumb,	Hazlenut,
Percimmon,	Strawberry,
Cherry,	Blackberry,
Black haws,	Whortleberry,
Thornberry,	Crab apple,
Walnut,	Gooseberry,
Mulberry,	Papaw.

These are generally to be found in all parts of the country, and where they occur are abundant. The grape, in particular, which is of a delicious kind, abounds every where. It is very common about the mines, as may be observed at *Mine à Burton*, *old mines*, and *Shibboleth*.

The soil thrown out of the pits sunk in search of ore, also produces several plants and trees which are not peculiar to the surface. Such are the poplar, or *cotton wood*, and *beach grape*, which are only found to flourish on the rich alluvial lands composing the banks of rivers. Nevertheless, I have seen these growing about the mouths of long neglected pits. the soil of which had been raised thirty or forty feet, and where, previous to digging, no such trees or vines existed. This fact is to be referred only to a difference in the quality of the soil at the depth alluded to, and warrants us further in the conclusion, that all soils are impregnated with the seeds of the trees and plants peculiar to them, as well at great depths as on their surfaces, and that they only require exposure to the sun, the air, and the light, to enable them to vegetate.

Respecting the botanical character of the mineral soil, it may be further observed, that although it yields but few forest trees, and they are not of a vigorous growth, yet a botanist might find his labours well rewarded by the profusion of shrubs and wild flowers which are every where found on the barrens. Some of these possess a singular beauty and fragrance, and I have particularly noticed a fine leaved plant, which is highly *sensitive*. It shrinks from the touch: it bears a very fragrant red flower in summer, and its stem is thorny. It has been called the *sensitive brier*. There are also some plants from which colours have been extracted for dyeing; such are peterswort crab-apple, shumac, upland dock, and smartweed, and a skillful botanist would probably discover many more.

The savages are in possession of some secrets in dyeing, the discovery of which is matter of moment. They dye a very beautiful and permanent red from some vegetable which is the production of this country. And the subject assumes a character of national importance, when we consider the immense sums we are annually paying to foreign nations for dyeing ingredients. Do not the western woods afford some substitutes?

The district of the lead mines is well watered, affording in all parts innumerable springs and rivulets of the most pure and wholesome water; and as the lands are high and airy, it is found one of the most healthy parts of the territory. Epidemics are unknown. Those diseases which prevail more or less every summer on the *American bottom*, and other rich and level tracts of Illinois, Ohio, and Indiana, have not found their way into the interior of Missouri, where there is no stagnant water,—no repositories for mud and slime, brought down by the annual floods, as is the case on the immediate banks of the Mississippi, Ohio, and other great western rivers,—and no pestilential airs from decaying vegetable, and drying ponds. The *fever and ague* is a very rare thing at the mines. Billious complaints are the most common, but they are not fatal. During a residence of ten months at the mines, I have not witnessed a single death, or heard of any happening in the country. At the same time, the margin of the Mississippi, on both sides, has been the scene of frequent deaths, and, during the summer months, of almost continued disease. There are, however, some losses annu-

ally sustained by the inhabitants of the mine tract, from the death of cattle, who die of the *mine sickness.* Cows and horses are frequently seen to die without any apparent cause. Cats and dogs are taken with violent fits, which never fail in a short time, to kill them. This has been accounted for, by supposing that they inhale the sulphur which is so abundantly driven off in smelting lead, and cattle are often seen licking about old furnaces. It is more probable that it arises from the sulphate of barytes, which accompanies the lead ore. This consists of the sulphuric acid united to barytes—*a poison to animals.* The mine sickness is wholly confined to quadrupeds.

The Merrimack and St. Francis are streams of the mine country, the former washing its northwestern boundary, and deriving much of its water from it, and the latter, originating in broken lands ten or fifteen miles south of Mine à Burton. Big River, Terre Bleau, Mineral Fork, Fourche à Courtois, and Indian Creek, are also considerable streams. Of a lesser size, are Flat River, Mine, Cedar, Wolf, Rock, Apple, Saline, Platten and Joachim Creeks, the four last falling into the Mississippi successively as you ascend the river from Cape Girardeau to St. Louis. These streams, with their tributary waters, afford farming lands of an excellent quality, both bottoms and uplands, and present a pleasing contrast to the sterile mineral hills on which they border. Indeed, in no other part of the western country is there to be found so remarkable a contrast, for the traveller is alternately presented with poor flinty hills, rich alluvial

bottoms, barren plains, towering cliffs, and level *prairies*, all mixed in a very novel and surprising manner, and affording some of the most picturesque scenes of rural beauty. The traveller, after he has viewed the rich uplands of Ohio—the heavy forests of Indiana—the woodless barrens of Kentucky—the craggy cliffs of Tennessee—and the unbounded prairies of Illinois, has still something to desire. for he may see them all together in one day's ride in the interior of Missouri. The whole country, after you cross the Mississppi, seems to have been projected on a different scale, the very rock formations are different, and the masses of *granite*, *quartz*, and *green stone porphyry* met with, attest its claims to antiquity. The western bank of the Mississippi from the head of Tyawapaty Bottom to St. Louis, is, with some exceptions, an almost perpendicular wall of limestone from one hundred to two hundred feet high, and affording in many places, some of the sublimest views of nature. The *Grand Tower*, *Dormant Wall*, *Hanging Dog*, and *Cornice Rock*, may be mentioned as instances of this. At this height the mineral soil commences, still rising by imperceptible degrees as you advance into the interior, and the whole Missouri shore seems to be sufficiently elevated to have served as a barrier to an ocean, which may have rested on the ground now occupied by the states of Illinois, Indiana, Kentucky, and Ohio. These are manifestly countries of newer formation, bearing innumerable marks of submersion, in the impressions of shells and animals found in their rocks, in the remains of animal bones, and in various other evidences, which a geologist

would consider conclusive of *secondary* formation.

The Lead mines are situated between the 37th and 38th degree of north latitude, and between the 89th and 92d degree of west longitude. The climate is mild and pleasant. It is not so hot as the same latitudes in Kentucky and Virginia. The last summer, (1818,) was considered unusually warm, yet I experienced no inconveniences from the heat, although from a country situated six degrees further north. The heat was manifestly great, but a gentle breeze was almost constantly stirring; and the uneven surface of the country is favourable for keeping up a current in the atmosphere. The fall was pleasant and serene, and the weather continued mild, until about the middle of December, when cold and disagreeable weather commenced, which continued nearly a month; during which, we had some flurries of snow, and it fell at one time three inches deep; the atmosphere then resumed its usual serenity, and continued about the temperature of April weather in New-York, until the middle of February, when chilly winds, slight snow flurries, and rains and sun-shine alternately characterized the days for a month more, and the spring opened, giving us a serene sky and mild warm weather. The weather is, however, subject to very sudden changes; a circumstance that will induce an emigrant to exclaim on the great heat one day, and on the great cold the next. The old people have very few signs by which they can foretel the weather.

The climate is well adapted for the raising of corn and wheat, which are the staple articles of the Missouri farmer. Rye also succeeds, but is not much cultivated. Oats, peas, turnips, flax and hemp do very well, but there is little of either raised. Irish potatoes, do not succeed well; the sweet, or Carolina potatoe was raised last year in considerable perfection. The soil and climate is well adapted to the culture of tobacco, and this is an article which is just beginning to excite universal attention. There will be a considerable quantity raised the ensuing summer in the county of Washington, and the country is said to be as well adapted to it, as Kentucky.

The farmer here encloses no meadows—cuts no hay.—The luxuriant growth of grass in the woods affords ample range for his cattle and horses, and they are constantly kept fat. Hogs also are suffered to run at large, and in the fall are killed from the woods; I have seen no fatter pork than what has been killed in this way. There is, perhaps, no country in the world, where cattle and hogs can be raised with so little trouble and expense as here; and this is an advantage this country possesses which is likely to be permanent; for the country will never admit of a dense population: (I allude particularly to the mine country:) here and there will be an excellent plantation, and the intermediate lands being too barren for cultivation, will never be taken up, but still afford a range for hogs and cattle. In Illinois, Indiana, and other parts, where such advantages now exist, they will shortly be curtailed, for the

lands being, generally speaking, all good, will be bought up, and every farmer confined to the limits of his own farm. The same advantage also renders the country particularly worthy of the attention of the shepherd. There is no country better adapted to the raising and keeping of large flocks of sheep, who would find excellent pasturage in the prairies and woods, and only require a hand to drive them to fresh pastures during the day, and guard them from wolves by night. Hay to feed them during the winter, might be cut any where in the post oak woods and prairies, and their wool would always bring a good price in the market; for the country affords every facility by its streams for erecting manufactories of cloth on an extensive scale. There are few sheep at present raised in the country; wool, and woollen goods of all sorts, are high and scarce, and I consider the subject worthy of the particular attention of the Missouri farmer. Horses are raised in considerable numbers by the inhabitants generally, and with little labour. They subsist themselves in the woods, both summer and winter, nothing more being required than to look after them, to see that no bells are lost, that they are duly *salted*, and that they do not go astray. They may be considered among the exports of the country, considerable droves being annually driven off to Kentucky, Red River, and other parts. It is to be observed. however, that a proper attention is not paid to improving the breeds, and though there are some elegant horses, the generality have a mixture of wild horse;

they are small, thick-set, and low priced. A good horse of this kind is sold for thirty dollars.

Respecting the wild quadrupeds in this part of the country, it may be observed, that they are annually decreasing, both in number and kind, and hunting is every year becoming less an object. Those, therefore, who are attached to this kind of life, are almost imperceptibly withdrawing further into the woods. The principal hunting ground near this is White River, some account of which will be given at the end of this work. The deer is still frequently met with in the mineral woods, and from the great body of waste lands, will probably long keep possession of them. The Beaver has been driven off. This shy animal is the first to abandon a country on the approach of men. He is generally succeeded by the Otter, who, from the natural enmity between them, is never found to inhabit the same stream.

The following is a list of such animals as are still to be met with:

Deer,	Otter,
Bear,	Muskrat,
Wolf,	Racoon,
Fox,	Opossum,
Wild-cat,	Rabbit,
Panther,	Pole-cat,
Hedgehog,	Fox-squirrel,
Weasel,	Grey-squirrel,
Mink,	Red-squirrel,
Gohar,	Mole.

Of birds there is an endless variety. The wild turkey is still very common on the bottom lands,

and during the heat of the day in the open post oak woods. The wild goose, duck, brant, and swan, are to be found on the streams. The pelican is occasionally seen on coming up the Mississippi, but never ventures into the interior. The prairie hen is common, so are quails and pigeons; the latter, in some parts of the interior, are so numerous that the woods seem alive with them. Of singing birds there is a numerous tribe; some of them are strangers to me, and there is a great proportion whose colours are beautiful, and who sing sweetly. I think an ornithologist would find this a very interesting field. The *parakeet* is a beautiful bird; it is a kind of parrot; its colours are green, yellow, and red, all bright colours, and it is a pleasing sight to see a flock of them suddenly wheel in the atmosphere, and light upon a tree; their gaudy colours are reflected in the sun with the brilliance of the rainbow: they are a noisy bird, but their notes are disagreeable. This bird is first met with on descending the Ohio, about the *falls*, after which they become plenty; are constantly to be seen on the Kentucky or Indiana shore, and add to the delight a traveller feels in descending that beautiful river. Of birds of prey, the eagle, the turkey buzzard, and the raven, may be noticed; but I forbear to increase the catalogue, for the subject is exhaustless, and to do it justice would require a greater limit than I propose to allow myself in this entire view. The mineral productions of this country are very numerous and interesting; for a catalogue of them see the miscellaneous part of this work.

The agricultural character of the mine country, although poor in the general estimate, is far less so than mining countries generally are; and viewed in detail presents a great deal of the most valuable farming lands. A spirit of husbandry is now generally prevalent; this has been yearly increasing since the United States acquired possession of the country, but has been particularly visible within the last 5 years. Farms are better tilled, and both the theory and practice of agriculture better understood than formerly. This is chiefly attributable to the emigration, which, within the last few years, has flown in so rapidly. Among the number has been several men of wealth and intelligence—practical farmers from the old states, who, at the same time that they have disseminated the principles of agriculture, have increased the respectability of the farming class, and taught them to appreciate, in a proper light, the farming interest. Perhaps, during this period, the mining business has been less attended to than formerly, and it would appear as if the increase of the one has kept pace with the decline of the other, but perhaps they both flourish best together.

Washington County, which is the richest in lead ore of all the mineral counties, and at the same time contains a great proportion of good farming land, now produces, over and above all home consumption, a considerable quantity of grain for distillation and for flouring; and beef and pork for foreign markets;—yet, there is a period in the history of the mining operations of this county,

when its annual produce did not equal its annual consumption.

With the advances in agriculture, a correspondent improvement has been effected in the manners and morals of the people. A large proportion of those formerly engaged in mining were persons of the most abandoned character, refugees from justice in the old States; and the mines were a continued scene of riot and disorder, and many atrocities were committed. Many of those persons have fled, others have been restrained from evil practices by the influence and example of virtuous and intelligent men, and it is but justice to the inhabitants of the mines to observe, that in morals and manners they are surpassed by no other district in the Territory. It would be difficult to point out a town or village west of the Mississippi where there is a greater attention to industry, morality, and religion, than at Mine à Burton. There are many of the refinements, and even elegancies of life; and in the courtesy and hospitality of the gentlemen, and the dress, conversation, and deportment of the ladies, a proof is afforded of the great improvement which a few years has effected in society.

There are but few Spaniards remaining in the district of the mines, or in the Missouri Territory; they generally withdrew on the occupation of the country by the United States. The French constitute a considerable proportion of the whole population, and it is but repeating a common observation to say, that in morality and intelligence they are far inferior to the American population.

The French are uniformly members of the Roman Catholic church. The religion most prevalent in other parts of the community is Methodism; the Baptists are next in number, and the late emigrations have brought in several Presbyterians, who are daily acquiring an accession of strength; and a few Episcopalians. There are but few regular buildings for public worship, and of those few I am unable to mention a single piece of respectable architecture. Worship is generally performed in private houses, and buildings erected for county or other public purposes: but considering the infancy of the settlements, perhaps more could not be expected. The benefits of common schooling are but partially felt, there is no system of school education. This is a business left to individual exertion and patronage. I believe there is no considerable settlement without a school, at least a part of the year.

Slavery was introduced into this Territory at a very early period, and previous to the occupation of the country by the United States. There are a considerable number at present; nearly every good plantation, and many of the mines being wrought by them. This observation has no allusion to the settlements on the Missouri at Boon's Lick, St. Charles, and other places, where emigrations are flowing in very rapidly, where there are many New England farmers who are averse to slavery in principle, and where indeed it is understood that slaves have been but partially introduced. This is a subject which excites some interest here at the present moment, when a petition

is lying before Congress for the admission of Missouri into the Union, and some fears are entertained that a Legislative restriction, with regard to slavery, may be introduced into the organic Law. Without inquiring into the constitutionality of such a restriction, it may here be observed, that from the temper of the people, it may be concluded that it is a privilege which will be hardly relinquished.

It is not to a country like this, that we are to look for internal improvements; it has been too recently the empire of savage ferocity, to admit of the amassment of superfluous wealth. There are few able to contribute great sums towards the construction of permanent roads, bridges, and canals. The subject is, however, kept in view; there are many who see with pleasure what other States are doing in this way, and the *New-York Canal* is a subject of frequent conversation among the intelligent part of the community. They are in the expectation of ultimately deriving a benefit from it, and anticipate with solicitude the connexion of Lake Michigan with the Illinois River, by which a water communication will be formed between Missouri and the city of New-York, *by way of Detroit, Buffalo, and Utica.* The river *Plein*, the main head fork of Illinois, approaches so near the head of Chicago River, which enters Lake Michigan at Fort Dearborn, that a communication exists in high water. I conversed with a trader last summer at St. Louis, who had come through in the spring, and afterwards saw his boat lying at the wharf. It carried from 4 to 6 tons, and was built *skiff-fashion*, with a flat bottom. He repre-

sented the undertaking as easy of execution, not requiring an artificial cut of more than 2 miles, and this through an alluvial soil. The roads through the mine tract are generally good, the mineral soil is well adapted for a road, and little labour is required to keep it in repair. When heavy and long continued rains have softened the ground, and the roads become *gullied*, such is the open nature of the woods, that the waggoner may drive aside, and pursue his way with very little inconvenience. From this circumstance the main roads from Herculaneum and St. Genevieve to the mines, have assumed a surprising width. A waggon loaded with lead, (and these are the principal ones who make use of the road) is particularly injurious in cutting up a road. On passing over a stick or stone it never rebounds, it is a dead fall, and it generally sinks to the strata of gravel. There are few bridges; that over the Joachim near Herculaneum, is a substantial wooden bridge. Ferries are kept at St. Genevieve, Herculaneum, Merrimack, Vetepush, St. Francis, and other places.

The culture of fruit trees, has not received a general attention in this country, if we except the Peach tree, which is found on almost every farm, and succeeds very well. The apple tree does very well where it has been tried, and some experiments also show the soil and climate adapted for Quince, Plum, and Cherry.

The country is also represented as adapted to the growth of Indigo. A gentleman of Bellevieu (Mr. Hutchins) raised this plant last summer in

great perfection. Madder, as is said, also succeeds. That useful vine, the *Hop*, grows spontaneously on the bottom lands, and is to be seen in great abundance, in the proper season, on the banks of the Platten, Apple Creek, and other places.

The manufactures of the Mine country, in addition to its grand staple, Lead, are not numerous. There are 3 shot towers, a like number of tan-yards, several flouring mills, and distilleries, and a few saw mills, where pine and oak boards and plank are made. There are several saltpetre caves worked, 1 powder mill, and pretty extensive salt works on Saline creek, St. Genevieve county. There are also 2 other salt works in Jefferson county, but they are on a smaller scale. Some tow cloth is made in families, and also cotton cloth for summer wear, and a carding machine and fulling and clothiers' works, have lately been erected on Big River.

The exports of Missouri Territory may be set down as follows:

Pig and Bar Lead,	Horses,
Shot, of all sizes,	Beef,
Whiskey,	Pork,
Flour,	Dried Venison,
Wheat,	Deer Skins,
Corn,	Furs and Peltries,
Hemp,	Butter,
Flax,	Pecans.
Tow Cloth,	

When its resources are properly drawn forth, the list will be greatly augmented, and a few years

will add the following articles, some exportations of which have already taken place :

Iron,	Nitre,
Zinc,	Salt,
Manganese,	Marble,
Sulphur,	Emery,
Arsenic,	Red Chalk,
Antimony,	Pumice,
Oil Stones,	Soap Stone,
Alum,	Gypsum,
Chalk,	Serpentine,
Plumbago.	Tobacco,
Flints,	Hops.

Commerce is now carried on chiefly with the cities of New-Orleans, Philadelphia, New-York, and Pittsburgh. The lead is taken down the Mississippi in boats to New-Orleans, and there either sold, or shipped to Philadelphia or New-York. The dry goods with which this country is supplied are principally purchased at Philadelphia, and waggoned across the Alleghany mountains to Pittsburg, and thence taken down the Ohio and up the Mississippi in boats. The groceries are principally purchased at New-Orleans, and brought up in boats. Steam Boats have lately engrossed this business, and should they continue to multiply at the rate now indicated, will in a few years throw keel boats and barges entirely out of the question.* Cutlery, glass ware, nails, red and white lead, castings, rope, paper, carpenters' and

* A list of Steam boats on the Mississippi and its tributary streams, will be found in the miscellaneous part of this work.

blacksmiths' tools, plough irons, and innumerable other works in brass, iron, and copper, are brought from Pittsburgh. Drugs, medicines, and dye stuffs, and sometimes dry goods, particularly for the Indian trade, are chiefly laid in at New-York, and thence shipped to New-Orleans. This trade has probably increased within late years.

The principal towns in the district of the Lead mines are, St. Genevieve, Herculaneum, Potosi, and Mine à Burton, and St. Michael. Some account may be given of each of these.

St. Genevieve is situated on the west bank of the Mississippi, 120 miles above the mouth of the Ohio, and 60 miles below St. Louis. The town, consisting of about 300 houses, including a Roman Catholic chapel, lies a mile from the landing at the mouth of the Gabbarie, and on ground which is handsomely elevated. Immediately below the town commences the *great field*, one of the richest tracts of bottom lands on the Mississippi. It extends five miles along the banks of the river, and is still held in common. This town was originally settled by the French from Kaskaskia, and although a considerable part of the inhabitants are now Americans, the French character still predominates. This is particularly observable in their amusements, dress, morals, and religion. St. Genevieve is one of the principal lead markets, and before the settlement of Herculaneum, all the lead made at the mines was shipped from this place. It is situated 30 miles below Herculaneum, is 45 miles distant from Potosi, 30 from mine La Motte, and about the same distance from Bryan's

mines and mine à Joe. Kaskaskia, the present seat of government for Illinois, is situated 7 miles from St. Genevieve, on the opposite side of the river.

Herculaneum, lies on a high bank of the Mississippi at the mouth of Joachim creek, and at equal distances from St. Genevieve and St. Louis. This town has been selected as the seat of justice for the new county of Jefferson, and being commodiously situated for business, and several miles nearer to the mines, is thought to possess advantages on that account. The town now consists of between 30 and 40 houses, including a court-house and jail, 4 stores, a post office, and school. There is also a commodious warehouse for storing lead and merchandise, kept by Elias Bates, and the town enjoys a considerable share of the lead trade, which has increased within a few years. In the vicinity of the town are 3 shot towers, where shot is made by letting it fall down the banks of the Mississippi, which here consist of high bluffs of limestone rock. The scites chosen for these towers is where the top of the rock overhangs the bottom a little. On this a building is erected, and other works prepared for smelting and casting the lead, and they are dropped through copper sieves into a receptacle with water below, where there is another building, and the operation of polishing is performed. For a detailed account of the processes of making shot as practised here, see section VI. *on the uses of lead.*

The following statement, of lead exported from Herculaneum, from December 31st, 1816, to June,

1818, a period of 18 months, places its advantages in a handsome light. It is copied from an official paper published by the proprietors of the town.

2,008,404 lbs. of Pig and bar lead, deposited at, and exported from Elias Bates' warehouse	$100,420.00
517,495 lbs. of lead, deposited with and shipped by sundry other persons	25,874.75
668,350 lbs. of Patent shot, manufactured by Elias Bates, and C. Wilt	46,784.50
5,500 barrels of Flour, manufactured by J. Horine, A. Van Zandt, and J. Bryan	41,250.00
44,924 gallons of Whiskey, manufactured by Horine, Van Zandt, and Bryan	32,192.62½
500 bushels of Wheat, shipped for N. Orleans	500.00
400 barrels of Beef and Pork	5,000.00
40,000 wt. of Bacon	4,000.00
66,000 feet of Pine boards, from Washington County	2,640.00
214,000 ft. of Oak boards and scantling	64,200.00
60,000 lbs. of Gunpowder, manufactured by Ashley & Brown, Washington County	30,000.00
	$352,861.87½

There are, within 4 miles of Herculaneum, 2 saw mills, 2 grist mills, 3 distilleries, and a tan yard, where considerable quantities of leather are made. It is situated 36 miles from Mine à Burton, 30 from mine Shibboleth, 25 from Bryan's mines, and 25 from Richwood's.

Potosi, and Mine à Burton, form one connected village, which may altogether consist of 80 buildings, including a court house, jail, and academy. When the County of Washington was erected by a division of St. Genevieve, a tract of land of 40 acres was laid off for the county seat, and named Potosi. This lies on a handsome eminence a little north of the principal mines, and separated only from mine à Burton by the mine creek. This village is pleasantly situated in the centre of the mining district, and surrounded also by several fine bodies of lands. It is built in a better style than the villages in the country generally, has a neat and thriving appearance, and contains several handsome edifices. Among these are the seat of M. Austin, Esq. and the court house, a building erected at an expense of $7000, and decorated with columns of the Doric order. It has 3 stores, 2 distilleries, (one by steam) 2 flour mills, 9 lead furnaces, 1 saw mill, and a post office, where a mail from St. Genevieve and St. Louis is received once a week, one from Arkansaw once a month, and one from Boon's Lick on the Missouri, once a fortnight. It is 65 miles distant from St. Louis, 45 from St. Genevieve, 36 from Herculaneum, and 45 from St. Michael. It lies in the centre of about 40 lead mines, all situ-

ated within a circle of 20 miles. The quantity of lead made at Mine à Burton has been very great. In a report made by Mr. Austin to the commissioner of the general land office, in 1816, the following estimate of the quantity of lead made, is given:

From 1798 to	1804,	360,000 lbs. per ann.	2,160,000
1804	1808,	800,000	3,200,000
1808	1816,	500,000	4,000,000
		Total amount for 18 years	9,360,000

See the perspective view of this village facing the title page.

St. Michael is situated on a plain on Village Creek, which falls into the river St. Francis a mile below. It is an old French village, of about fifty houses, including several stores, and a post office; and lies in the centre of the richest farming district in Madison county. The seat of justice for the county, has lately been fixed on rising grounds, about six hundred yards south of the village, and a town laid out there called *Fredericktown*. Several emigrants have lately located themselves in St. Michael, and since the county seat has been fixed in its vicinity, it has assumed a thriving appearance. The Mine La Motte lies two miles north of the village.

New-Bourbon, *Caledonia*, and *Madansburgh*, are also towns of the mine tract, but they are at present small. The last two have lately been laid out, and bid fair to have a rapid increase.

Having now taken a general survey of the Mine country, there are a few remarks which may be made on the counties *separately*.

St. Genevieve County. The mineral productions of this county are lead and salt. Bryan's mines, and Mine à Joe, are the most noted. Salt is made on Saline Creek, a stream which falls into the Mississippi eight or nine miles below the *great field* of St. Genevieve. The works are at a village called Madansburgh, and are on a respectable scale; and much of the salt consumed in the interior, is the produce of these works. The springs are considered lasting, and the water strongly impregnated, and preparations are now in forwardness to enlarge and improve the works.

There is a large white body of silicious sand in the interior of this county, and which, from examination, I think adapted for the manufacture of flint glass. It lies eight miles on the road to Potosi, where it is found in a cave of unexplored extent. The sand is in the aggregated form, i. e. sand stone; is very white, easily crushed between the fingers, and falls into a very fine, even-grained, transparent, quartzose sand. It appears to me, from external character, to possess the property of easy fusibility, one of the most desirable qualities in glass-sand; and from an acquaintance with the subject, I am led to conclude, that it will prove a very valuable material in the manufacture.

One of the most noted bodies of farming land in St. Genevieve county, is *Bois Brula Bottom*, extending for near twenty miles on the margin of the Mississippi. This bottom is covered with the heaviest growth of trees, shrubs and vines, such as are peculiar to the richest Ohio bottoms. The settlements on it, are considerable, and daily in-

creasing, and it yields in perfection most of the productions which have already been mentioned as the produce of the mine country, particularly corn, which attains an almost incredible height, and yields a heavy crop.

The principal farming tracts in the interior, are *Murphy's Settlement*, and *Cook's Settlement*, both extending along the main road that leads from St. Louis to Arkansaw and Red River. At Murphy's Settlement there is a post office. This county sends five members to the territorial legislature.

Washington County. This county, although the seat of the principal lead mines, is at the same time not deficient in farming land. Bellevue, Stout's settlement, Richwoods, and Old mines, may be mentioned as instances of this. The southern banks of the Merrimack, Big River, and Fourche à Courtois, also yield handsome tracts of the most fertile bottom lands. The lands in Bellevue, are particularly noted for their fertility, beauty, and extent, and the population in this township is numerous, and very rapidly increasing. Caledonia is in this township, where several buildings are now going up, and among them, a house for public worship. Stout's settlement, lies south of this, on the tributary waters of the St. Francis, and is represented as a body of choice land. On the Fourche à Courtois there are a number of plantations, and the lands will admit of many more. A tract of bottom land now in the possession of the Delaware and Shawnee Indians, is often noticed for its beauty and fertility. Big River, in its whole course, which is long and devious, and al-

most completely subtends the north, east, and south boundaries of Washington county, affords the finest of farming lands. Such are the principal farming tracts of this county, which although detached, with ridges of poor land intervening; yet taken in the aggregate, bear a respectable proportion to its whole number of square miles, and exalt its agricultural character above that of the other mining counties, St. Genevieve excepted.

The traveller can no where go into Washington county, keeping the main roads, without passing over some of the most sterile soil in it. For the sake of getting good roads, they have been carried along the tops of the most sterile flinty ridges, running in the required direction, and when one deviated too far, it has been left, and another ascended. This is the character of the country; it lies rolling, and is in no places better instanced, than in the great roads from St. Genevieve and Herculaneum to the mines. The traveller riding along these, is so impressed with the almost unvaried barrenness of the county, that by the time he reaches Potosi, he is ready to exclaim against it, and without stopping to inquire into its particular advantages, rides back with the most unfavourable impressions. From such causes it has generally been underrated by former tourists and travellers, who may have had but a few moments to spare, and even improved those by making inquiries of the most illiterate part of community. A man who merely rides through a country, cannot be expected to publish much valuable information concerning it. The inquiry of a moment,

the surmises of ingenuity, and the probability of things, can never atone for sound statistical information, practical remarks, and acknowledged facts. It is necessary to enter into details, before we can arrive at a general result—to establish small facts in order to render larger ones certain—to view in detached bodies, as well as collectively, and indeed before we can pretend to decide on the character of a country to collect, compare, and contrast all its advantages and all its disadvantages; and this cannot be done in a moment. A man may have a glimpse, and not a view—he may see, and yet not understand—he may believe, and yet be mistaken. It is from these facts, and knowing how deep first impressions, however erroneous, sink, that I have been induced to hint at the superficial accounts of preceding tourists; and however exceptionable the remark may be in a general sense, it applies forcibly in a particular one. I allude to some works on the western country now generally read at the eastward—to some who are even referred to as text books—to labours of mercenary pamphleteers, and catch-penny printers, where we are served up with surmises instead of facts, with bloated descriptions instead of simple accounts; and the authors of which, in many instances, know not the countries they describe, and have neither admired the beauties, or shrunk at the deformities, which they picture.

In adverting to the agricultural character of this county, its advantages for raising cattle, sheep, horses, and hogs, may claim particular attention. The growth of prairie grass in the open post oak

woods and prairies, is of the most luxuriant kind, and stock may be raised at a trifling expense. The barrens are also covered with a profusion of wild fruits, (grapes particularly) and wild flowers, and in the fall there is abundance of acorns, on which hogs fatten. Its mineral productions, in addition to lead, are zinc, iron, ochre, red chalk, saltpetre, sulphur, alum, and salt. There is in the township of Bellevue a salt lick called *Chicago*, where some attempts have been made to find salt, but the rock was only penetrated about 10 feet, and quite brackish water found at that depth. The lick is on public land, and as no one will run the risk of losing his labour, it remains unexplored; little doubt, however, can exist, that salt water would be found at no great depth. There is also in Bellevue a very extensive *Buffalo Lick*, called Bates' Lick, (being partly on a tract of land owned by Moses Bates) which covers about 12 acres of ground, and is in some places 10 or 12 feet deep. Strong indications of salt have been found at this place.

Bellevue abounds in granite and iron ore, particularly on its southern boundary, which is the poorest part of it; and on Cedar creek, which is a fork of Big River. A piece of antimony was found in this part of the township several years ago, but no body of it has yet been brought to light. There is a singular cave where *alum* is procured near McCormick's.

The iron of Bellevue is a subject of universal notoriety. In the richness of the ore, and extent of the beds or mines, it is no where paralleled.

The most noted place is called the *Iron Mountain*, where the ore is piled in such enormous masses as to constitute the entire southern extremity of a lofty ridge, which is elevated 5 or 600 feet above the plain. Immediately at its base commences a tract of the richest bottom lands, through which a stream called Chartier Creek meanders, and passing round the western side of the mountain, falls into Cedar Creek a few miles below. A seat for working the ore is situated about 7 miles to the N. W. on Cedar Creek, and another sufficient to drive any number of forges 8 miles distant on Big River. Within 2 miles from this, on a small creek, there is a sufficient fall and plenty of water for establishing an extensive foundery.

The iron mountain is claimed under a concession to Col. Valley, the last Spanish commandant at St. Genevieve, but has not been confirmed by the American government, and some doubts are entertained whether it will.

Respecting the quality of the ore, it may be added, that it is probably of the richest kind, and such as is well adapted for the manufacture of bar iron. It is very heavy and brilliant, and is of that kind denominated *micaceous oxyd of iron*, in mineralogy. Mr. Miller, an iron-master of Augusta county, Virginia, on visiting this place last fall, thought the ore of an excellent quality, and seemed absorbed in astonishment by the immensity of the body. The ore has been tried by Maj. J. Hawkins of Potosi : it ran easily in a slag furnace, and without any flux ; and Mr. Robert C. Bruffey, an intelligent mechanic of the same place.

has experimented upon the iron obtained from the ore, by heating, hammering, hardening, &c. He found it very malleable, and easily worked, and considers it iron of the best quality.

There is another remarkable body of iron ore, in Stout's settlement, 5 miles west of the Iron Mountain, scarcely inferior to it either in the extent or riches of ore. It has also a seat for water works near it. Several other beds exist in the same neighbourhood, but none equal to the surprising bodies already mentioned.

Ores of zinc are found at several of the lead mines in Washington; the principal bodies are at Mine Renault, and Elliott's mines. It is also frequently met with at the numerous diggings on the mineral fork. I have some specimens from Brushy-run, and New Diggings, both within 2 miles of Potosi. It is also occasionally met with in small bodies, at several other mines in this county; and considering the rarity of this metal in America, and its extensive usefulness, which is yearly increasing, I have no doubt it will shortly attract the attention of some capitalist, and become a source of much profit. The ore generally accompanies the lead; is of that kind called *Blende* by mineralogists, and is the *sulphuret of Zinc* of chemistry.

In addition to the amount of lead annually made in Washington county, there is a considerable quantity of flour, whiskey, and other articles manufactured. The following is a list of the differ-

ent mines and manufactories now established, (Feb. 1819.)

38 Lead Mines,
34 Lead Furnaces,
16 Grist Mills,
8 Saw Mills,
10 Distilleries, (one by steam)
3 Salt petre caves, (worked)
1 Powder Mill,
1 Alum cave, (not worked)
6 principal Iron Mines, (not worked)
1 Tan yard.

Washington sends 4 members to the Legislature.

Madison County. This is a small county lately erected from a division of St. Genevieve and Cape Girardeau, and forming the southern limits of the mine tract. Its mineral products are lead, iron, granite, and Plumbago. There is but one lead mine in the county; it is mine La Motte. Lead has, however, been found in several other places, though no mines have been opened. The granite is employed for mill stones, and bears the test of experiment. The only vein of granitic rock in the Mine country, (so far as I have had opportunity to observe,) passes across the south western end of this county, and runs into Bellevue, (W. Co.) It is 4 or 5 miles wide, and extends altogether from 20 to 30 miles in a direction from S. E. to N. W. Considering the rarity of this rock, and the strong geognostic affinity which some of the more valuable metals have for it, it is not unreasonable to suppose that such metals may exist

in it, and which a better acquaintance with the country may discover. On a visit there lately, I found several rare and beautiful specimens of greenstone porphyry; the colour a greenish black, spotted with flesh red, passing into green on the edges. Unmagnetical pyrites of iron is common, so is quartz, and several spars. The principal district of good farming land in this county lies along village creek, and the eastern shore of the St. Francis, which runs through this county in a course nearly north and south. This river enters the Mississippi 500 miles below, pursuing its meandering, and is about half that distance in a direct line. A raft of trees, brush, &c. obstructs the navigation for boats, which would otherwise be uninterrupted to within 14 miles of St. Michael, and whenever this is removed, the produce of this county will find a ready way to New-Orleans, and foreign merchandise be brought up at a cheaper rate. Goods are now wagoned over from St. Genevieve. Madison is entitled to send one member to the Territorial Legislature.

Jefferson County. The general mineralogical character of Jefferson county, though less flattering than the preceding, is nevertheless interesting. The rock formations in this county are, so far as observed, chiefly limestone, which, although less metalliferous than granite, yet yields several of the useful, and in some cases, the precious metals. It runs into a kind of marble at Herculaneum, which is overlaid by a stratum of secondary limestone, bearing impressions of marine shells, animalcula, &c. The *Rock Fort*, a remarkable ledge

on the Mine à Burton road, consists of a coarse grey sand stone, and the vein may be traced S. as far as Rock Creek, a distance of 60 miles. Lead has been found in several places in this county, it has only been worked at *Gray's mine*, and *McKane's mine*, the latter situated on Dry Creek, a stream running into Big River from the Jefferson side. Lead has further been found on the head of Joachim Creek, 18 miles on the road to Potosi; on Col. Hammond's plantation, 4 miles from Herculaneum; on the Platten near McCormick's; and on the Joachim near Conner's. Iron ore is found in Big River township, near the ford at Todd's, and on Platten and Sandy Creeks. Salt was formerly made at works on the Merrimack. The water is represented to be strong, but the works have been suffered to lie idle, in consequence, it is understood, of a dispute respecting the land title. Other works 8 or 9 miles from Herculaneum on the road to St. Louis, are now in operation, and salt of a good quality manufactured.

The *sulphur springs* in Jefferson county are sometimes resorted to by persons suffering from bilious complaints. They are thought to give relief in such cases, and an idea of their beneficial effects is generally prevalent among the inhabitants, who drink the water in large quantity. No analysis has been made to determine the medicinal properties of this water. It appears to me to be less impregnated with sulphur than those I have been acquainted with in the Genesee country, New-York.

Jefferson county has several saw and grist mills,

3 shot manufactories, a tan yard, and 3 distilleries. The principal farming districts are the banks of the Platten, Joachim, and Sandy Creeks. The southern shore of the Merrimack and the eastern banks of Big River also afford good lands. This county is represented in the Legislature by one member.

In this general outline I have confined my remarks to that district of country extending from the Mine La Motte on the St. Francis, to the Richwoods on the Merrimack, and from the Mississippi west to the Fourche à Courtois, making an oblong square of about 70 miles by 45, and comprising a tract of a little upwards of 3,000 square miles; but although this is properly speaking the seat of the lead mines, ores of lead have been found at several other places, and we are warranted in the conclusion, that when the interior comes to be properly explored, the lead district will be found much larger; and I doubt not but some of the richest mines remain yet undiscovered.

I have considered Madison County as the southern extremity of the mine tract, but lead ore has been found in the adjoining county of Wayne, on Otter Creek, and recently it has been discovered on Strawberry River, in Lawrence county. It is also found on the head waters of White River, on James River, on the head of the Merrimack, on the Arkansaw, Gasconade, Osage, and Mine River of the Missouri, and also on the Desmoine of the Mississippi; but the quantity has been little at many of these places, and no furnaces for smelting in the large way have been erected. The appear-

ances in some places are however flattering, and such as to warrant the expenses of searching for bodies of the ore. On the Arkansaw in particular the quantity of ore in view is represented as very great, and from a series of experiments made by Messrs. La Fitte and Bronsheaux of New-Orleans, the ore is found to contain a sufficient *per cent.* of silver to render the separation in the large way a work of profit.

The mineralogical character of the country on James River* is also such as to render it extremely probable, that large bodies of lead exist in that quarter. This stream is one of the head forks of White River, entering from the north west, and on a tour I lately made through that country, I brought away samples of lead ore which bear a comparison with the best Mine à Burton ores; and as I since find on assay, they are equally rich. Lead has also been found at the *Bull Shoals*, and on *Trimble's plantation* on White River, but no pains have been taken to ascertain the extent of the ore. At the former place it is found adhering to the rock on the margin of the river, and accompanied by such *stony* substances as are common at the lead mines. The place is further rendered interesting by some remains of ancient works found in the banks of the river, which consists of alluvial soil, 15 or 20 feet deep, reposing on limestone rock. In this bank pieces of *metallic lead*, of *earthen pots*, &c. have been discovered imbedded in the firmest part of the soil, at the depth of 15 feet; the surface being covered

* For an account of this stream, see the annexed description of White River.

by a heavy growth of forest trees. A few miles lower down, Indian arrow heads chipped out of flint, are found imbedded in the bank in the same situation, accompanied by small animal bones. In descending the river a month ago, (Jan. 1819.) I stopped at this place, and brought with me a bit of lead in the metallic state, dug out of the earth, and which is manifestly the production of art. It is not perfectly malleable, though it may be cut with a knife.

The lead mines at *Prairie du Chien*, are situated in the North Western Territory, and do not fall within the view here proposed to be given. It may however be remarked, that they are considered the richest yet found. They are still in the possession of the Sacs and Foxes, the original owners of the soil, by whom they are worked in a very imperfect manner. They were formerly wrought by M. Dubuque, under the authority of a Spanish grant, and with consent of the Indians, but since his death they have manifested an unwillingness to allow any white man to work them, and appear to entertain a high sense of their value. M. Dubuque dying in debt, the mines were afterwards sold for the benefit of his creditors, but the Indians denied all former concessions, and thus a dispute originated, which is still unsettled. According to Lieut. Pike (the late General Pike) they are situated 450 miles above St. Louis, pursuing the meanderings of the Mississippi, and six miles from the river's banks. From the information given to Lieut. Pike by M. Dubuque, the mines extend 27 or 28

leagues in length, with an average breadth of about 3 miles; they yield (on the scale then worked, A. D. 1805) from 20 to 40,000 pounds of lead per annum, and the crude ore yields seventy-five per cent. of metallic lead. It appears also that some copper accompanies the lead, but on this head no satisfactory information is afforded, and the mines have not been explored with a mineralogical eye.

In order to convey a just idea of the mines, I thought a general description of the country in which they lie, would be proper:—some facts relative to the soil, climate, productions, state of agriculture, commerce, manufactures, and general mineralogical character of the country. To aid the reader in forming an estimate of these, is the object of the foregoing details, and I shall now proceed to an enumeration of the different mines; the method of working them; the quality of the ore; accompanying minerals; annual produce, &c. To acquire this information I have spent much time and attention. I have visited every mine of consequence, with the view of learning its particular character and extent; and to notice its *peculiarities.* I have made a personal examination of the whole mine tract during several journies, undertaken with the sole view of learning its physical geography—its principal streams, mountains, mines, farming lands, and other prominent features. If, therefore, I have failed to collect a body of useful information on the subject, it can neither be owing to a want of industry or opportunity.

SECTION III.

Of the different Mines, Ores, and accompanying Minerals.

Since the first discovery of lead in this territory, the number of mines has been constantly increasing, and hardly a season passes, in which some new discovery is not made. As the prospects of ore, in such cases, are generally very flattering, a number of miners are soon drawn together, and the older mines, are either partially deserted, or wholly abandoned. Thus a constant scene of bustle and discovery is kept up, and the change of situation, with the constant hope of falling suddenly on a great body of ore, gives a perpetual relish to their labours. The miners generally work on their own account; they are constantly on the alert, and when a new discovery is announced, eagerly exchange the slow but sure profits of working in an old pit, for the prospect of finding larger bodies near the surface. Many old mines are, therefore abandoned, which are not exhausted; the progress of discovery is ever advancing, and when a company of miners have once forsaken a pit on account of its depth, or some difficulties experienced in raising the ore, they are seldom known to re-occupy it; and should the discovery made not prove valuable, which is sometimes the case, the concourse collected, generally make it so, for, unwilling to be disappointed, they fall to

work, and tear up the whole surrounding country. It must be an extraordinary thing if, with such a search, a large body of ore is not found. The very extensive district over which the ore is scattered, affords ample scope for the industrious and enterprising, and keeps a number always in search. This alluring hope—this constant itch for discovery, although productive of the greatest advantages to the public, has, at the same time, one pernicious tendency, for much time is thus consumed, in hunting new beds of ore, which if spent in labour upon the old ones, would be found infinitely more advantageous. Thus a kind of laziness is created, habit is powerful, and as the pleasures of labouring people arise chiefly from their employments, many become attached to this kind of life, and they who spend the most time in hunting for ore, spend the least in digging it.

The following is a catalogue of the Mines. It comprises those of most note, which are now worked, or have been at some former period.

Mines.	*Situation.*	
1. Mine à Burton,	Burton Township,	Washington Co.
2. Mine à Robino,	do	do
3. Mine à Martin,	do	do
4. New Diggings,	do	do
5. Citadel Diggings,	do	do
6. Perry's Diggings,	do	do
7. Hawkins' Mine,	do	do
8. Rosebury's Mine,	do	do
9. Austin's Shaft,	do	do
10. Jones' Shaft,	do	do
11. Rocky Diggings, (Prairie de Rochè)		do

Mines.	*Situation.*	
12. Gravelly Diggings,	Burton Township,	Wash. Co.
13. Brushy-run Diggings,	do	do
14. Stricklin's Diggings,	do	do
15. Bibb's Diggings,	do	do
16. Tebault's Diggings, (Pinery)	do	do
17. Mine Astraddle,	do	do
18. Masson's Diggings, alias Partney's,	do	do
19. J. Scott's Diggings,	do	do
20. T. Scott's Diggings,	do	do
21. Micheaux's Diggings,	do	do
22. Henry's Diggings,	do	do
23. Moreau's Diggings,	do	do
24. Tapley's Diggings.	do	do
25. Lambert's Diggings,	do	do
26. Old Mines,	Union Township,	do
27. Mine Shibboleth,	do	do
28. Elliot's Mines,	do	do
29. Belle Fountaine,	do	do
30. Cannon's Mines,	do	do
31. Little Diggings,	do	do
32. Becquet's Diggings,	do	do
33. Mine Liberty,	Liberty Township,	do
34. Renault's Mines,	do	do
35. Miller's Mine,	do	do
36. Mine Silvers,	do	do
37. Fourche à Courtois	do	do
38. Pratt's Mine,	Big River,	do
39. Lebaum's Mine,	Richwoods,	do
40. Mine à Joe,	Flat River,	St. Genevieve Co.
41. Bryan's Mines,	Hazle Run,	do
42. Dogget's Mine,	do	do
43. Mine La Motte,	St. Michael,	Madison Co.

44. Gray's Mine,	Big River, Jefferson Co	
45. M^c Kane's Mine,	Dry Creek,	do

The numerous mines or diggings in Washington County, are chiefly situated in the vicinity of Potosi, and have generally been considered under the head of Mine à Burton. They are, however, situated at different places, at considerable distances asunder, and from their extent, and mineral character, appear to be entitled to individual consideration. Several others of less importance, have been omitted.

These mines possess one general mineralogical character, although there are some *peculiarities* which I shall afterwards mention. The ore is found in detached pieces, and solid masses, in veins and beds, in red clay, and accompanied by *sulphurate of barytes*, *calcareous spar*, *blende*, *iron pyrites*, and *quartz*. The ore is of that kind called by mineralogists, *lead-glance*, or galena, and is the *sulphuret of lead*, of chymistry. As it is dug up, or quarried from the adhering spar, it presents a very rich appearance. It has a broad glittering grain, of a lead-gray colour, which sometimes passes into a bluish shade. This particular colour may not be recognised on a superficial view, for when the ore is piled in shining heaps at the mouths of the mines, there is so rich and dazzling a reflection of light, that it appears *white*, and a person unacquainted with ores, might readily mistake it for silver. The ore is easily broke by the blow of a hammer, and may be pounded to a fine powder; it still preseves its glittering appearance, and is sometimes used in this state as *paper-sand*, for which it is an elegant

substitute. In breaking it, a mathematical law is observable; it always separates in cubes, which are more or less perfect, and on pounding, it continues to preserve this figure, until the particles become too minute to discover their particular shape. Sometimes detached lumps of four or five pounds weight, of a cubical form, are found imbedded in the clay. Its primitive figure of crystallization, is particularly observable after the ore has been desulphurated by heat, which, at the same time, increases its splendour, and renders the lines of intersection between the the facets in which the ore is crystallized, more plainly discoverable.

The clay, or red earth in which the ore is found, appears to partake largely of marl, and a differance in the quality, is to be observed at the different mines. It all, however, operates more or less as a manure on being thrown out of the pits, and in a few years, is covered with a very rank growth of trees, vines, &c. This is so characteristic a trait of all old diggings, that it will not escape the observation of the most superficial visiter. Mixed with the clay are innumerable pieces of radiated quartz, very beautiful in appearance, and sharp fragments of flinty stones. These form the first stratum, and are about fourteen inches in depth, then succeeds a stratum of red clay, four or five feet thick, and sparingly mixed with substances of the same kind, and after this a layer of gravel and rounded pebbles of a silicious character, is struck; these are about a foot in depth, and lead ore, in small detached lumps, is then found. The thickness of the bed of ore, is generally a foot; and the lumps of ore

appear to have been rounded by attrition, like common gravel. This is the character of what is called the *gravel ore*, and no spars are found accompanying it. The greatest proportion of lead ore, is, however, found imbedded in, and accompanied by the sulphate of barytes, resting in a thick stratum of marly clay, bottomed on limestone rock. The rock is invariably struck, at a depth of from fifteen to twenty feet, and puts a stop to the progress of the miner in a common way. To go further, it is necessary to drill and blast, and this creates an expense, which the generality of diggers are unwilling to incur, if not unable to support.

The most valuable substance accompanying the lead ore, is *blende*, an ore of zinc, which is found at several of the mines; and there is reason to conclude, that large bodies of it exist. This is the *sulphuret of zinc* of chymistry, and is the same substance called *black-jack* by the English miners, and sometimes also called *pseudo-galena*, and *mock-lead*, in writings on the subject. As few are acquainted with its nature or properties, and no one appears to be aware of its uses, no search has been made for it, and, indeed, in digging, they have rather avoided places where it was most abundant, considering it an useless thing.

The other substances found with the ore, though not very useful in themselves in the present state of our knowledge, will be sought with avidity by the American mineralogist, as affording specimens which are seldom met with in any other part of the Union; and they certainly tend to increase the gratification which a person feels on visiting the

mines. The sulphate of barytes, (called *tiff*, by the lead diggers here,) is the same substance called *cawk* by English miners. These are both local terms, invented by the miners, who as they read few books, cannot be presumed to make use of the terms proposed by mineralogical writers, and accordingly make use of their own terms, which it is nevertheless necessary that scientific readers should become acquainted with. *Tiff*, *cawk*, and *sulphate of barytes*, are therefore one substance, consisting of the earth *barytes* united to the *sulphuric acid.* It is a very white, and a very heavy spar, and may be considered as the proper matrix of the lead ore, as it is found imbedded in, and often completely enveloped by it. It is extensively useful as a chymical re-agent, or test, and is recommended as one of the best fluxes for iron ores, in smelting in the large way.

Calcareous spar, is merely a carbonate of lime, in the crystallized form, and the figure of the crystal is a rhomb. This it invariably assumes, however broken, and may be observed, when no bigger than a grain of sand. Its colour is either white, or honey-yellow; it is transparent in a considerable degree, and very much resembles sparry-gypsum, for which it has been mistaken by several travellers who have visited the mines. This spar is here known, under the name of *glass-tiff*. Some specimens have the transparency of the *Iceland spar*, and exhibit double refraction. Iron pyrites, is a combination of sulphur and iron, and though classed as an ore of iron, is never wrought in the large way. It is, however, largely employed in several

parts of Europe, in the manufacture of green vitriol, and sulphur is sometimes procured from it, by sublimation. In this process, a red oxyde of iron is left, which is used as a pigment. Pyrites are common at the mines, sometimes crystallized in regular cubes of a beautiful brass-yellow colour, and at others, found in tabular masses, or mixed with blende, sulphate of barytes, or calcareous spar. The former variety has generally been mistaken in this region for *gold*, and many of the stories in circulation of the existence of this metal in the interior of Missouri, have no better foundation. I have disappointed several miners and hunters who brought in specimens, by telling them it was merely a combination of sulphur and iron. Quartz is found throughout the whole mine district, both on the surface of the ground, and at all depths below. It is generally in the form of tabular pieces, whose surfaces are thickly studded over with small pyramids of transparent rock crystal, and presenting an appearance of the utmost beauty and splendour, looking like so many diamonds set over the surface of white stone. These crystals are frequently grouped in the form of a hemisphere, circular, or oviform, solitary or in clusters, forming the different varieties of mamillary and radiated quartz, and when met with in their pristine beauty, present a very rich and brilliant appearance. The mine country is characterized by this variety of quartz, which is generally found in the neighbourhood of mines, and such a geognostic affinity is it supposed to have with lead, that it has acquired the popular name of *blossom of lead*, or

mineral blossom, a term perfectly significant of the supposed affinity. It is known by no other name among the miners and commonalty of people in Missouri. Of the uses of quartz, it may here be observed, that is it largely employed, under different names, in the manufacture of porcelain and glass. Silicious sands are merely quartz, in the granulated form. Rock crystal is a variety of quartz, so is *prase*, *sinople*, and *amethyst*. Quartz enters as an ingredient into all vitrescent mixtures, hence is largely employed, not only in glass, but *smalts*, *artificial gems* or *pastes*, *enamels*, *glazings*, and *azure*. Perhaps the kind under consideration is less adapted for these purposes than most others.

These substances are generally found accompanying the lead ores at the mines. The blende is, however, often missing, sometimes the calcareous spar is also wanting, sometimes the pyrites, very seldom the heavy spar, and still more so the quartz. This is almost invariably present, though not always found at the immediate place of digging. These variations in the mineral character of the mines, with some further particulars connected with them, will render a separate notice of a few of them necessary.

Mine La Motte. This is one of the oldest mines in the Territory, having been discovered A. D. 1720, by the person whose name it bears. The mines are very extensive, and a large quantity of ore is annually raised. They are situated within 2 miles of St. Michael, Madison county, and on the head waters of the River St. Francois. No spars are found accompanying the ore; iron pyrites is

occasionally met with, and plumbago is found in the vicinity. The ore, which is less brilliant, and differs in other characters from any other in the mine tract, is at the same time more refractory, and in some instances the greatest difficulties have been experienced in the smelting. Hence an idea has originated, that it is combined with other metals, particularly silver: but no experiments, I believe, have been made to ascertain this point. It yields little lead, comparatively speaking: 50 per cent. is the extent, and the quantity often falls short of this. On a visit to these mines, I observed the inside of the *Ash Furnace* beautifully tinged with a blue colour of considerable intensity. This furnace is built of a white sandstone, which becomes vitrified on the surface, forming glass. We are acquainted with no substance which will communicate a blue colour to glass in fusion, but cobalt; hence it is not unreasonable to infer that this metal is volatilized during the smelting, and is thus brought into contact with the liquified surface of the stone, imparting to it the colour noticed. That the ores of La Motte contain an unusual portion of sulphur is very probable. I draw this inference both from its refractory nature and dull appearance. Sulphur always renders an ore refractory, for when it is expelled by torrefaction, it melts easy. Its dull aspect is not less conclusive, for the more an ore is roasted, the more sulphur there is driven off, the *brighter* it grows. This is evident to every smelter, who cannot fail to observe the surprising brilliancy the ore assumes after it has gone through the first operation

in the log furnace. That the difficulties daily experienced in smelting the La Motte ores are, therefore, attributable to the extraordinary quantity of sulphur they contain, is extremely probable. For even if they were united with other metals, with silver or with cobalt, these would not increase their infusibility except by the extra quantum of sulphur they brought with them. At least we have no facts to prove that a simple alloy does not melt as easy as a pure metal, while there are many to show that alloys are of the most easy fusibility. Such is that made from tin, lead, and bismuth, which will melt in a tea-spoon held in a cup of hot tea: but it requires a red heat to melt either simply. Where an ore contains sulphur, it must be expelled by roasting, and the more sulphur, the more roasting is required. This is the only remedy, and if the smelters at La Motte will take the pains to desulphurate their ores completely previous to fusion, I do not doubt but they will have a pleasant and profitable result.

New Diggings. The quantity of ore raised at these mines has been very great, but they have been abandoned several years ago, on account of the water which rushed in with such rapidity, that to remove it every morning with a common windlass and bucket was found a work of such labour as to render the business unprofitable. The mines were left with the most flattering veins of ore in view. The general character of these mines is such as to justify the expenses of the erection of a steam engine, and other works for prosecuting

the business on an extensive scale; and their revival at some future period may be confidently looked for.

Mine Renault, is situated about 6 miles N. N. W. of Mine à Burton, in a very rocky part of the country, and affording some of the most picturesque views of mountain scenery. The country is strongly marked by mineral appearances, which render it probable that other substances of value besides lead may exist in that vicinity. Ores of zinc are abundant at this mine; it is black blende. This is among the number of long neglected mines, where the ores near the surface have been exhausted, and the want of proper machinery, and mining capital, has barred a further progress. They derive their name from Phillip Francis Renault, who made the discovery about a century ago. A body of micaceous oxyd of iron is found near this mine.

Bryan's Mines, on Hazle Run, are among the most recent discoveries of consequence. Near a million pounds of lead were made here during the first year of the discovery. The mine is characterized by yielding no spars; sometimes a little calcareous spar is found, and then adhering to the ores, a circumstance which I have no where else observed. No heavy spar, pyrites, or blende, have been found. Much of the ore of these mines is found in tabular pieces, which are sonorous in a considerable degree; the ore is brilliant, and smelts readily, yielding the same as Mine à Burton.

Gray's Mine, situated on Big River, on the northern extremity of the mine tract, is remarkable for

a body of *white clay*, which was discovered in searching for ore. In sinking several pits at this mine, in search of ore, a stratum of clay of an unusual appearance was struck at the depth of from 8 to 10 feet, and no ore was procured at those places, but the diggings were abandoned in consequence of the clay, which covers a considerable area of ground on the banks of Big River. This mineral substance bears a striking resemblance to a specimen of German crucible clay in my possession, and I have employed it in small crucibles in analysis, where a very intense heat was given, without discovering any other marks of fusion but such as are common to the best Hessian crucibles. Hence it is not unreasonable to conclude, that it is not only adapted for crucibles, but may also be employed in the making of glass-house-pots, where a clay of the utmost purity and infusibility is required. The clay under consideration is manifestly the result of decomposed shale, as this mineral is to be observed in all stages of the decomposition.

Elliott's Mines. These lie upon the mineral fork, and are characterized by the abundance of pyrites, and the beauty of the calcareous spar found there. Considerable quantities of blende were also met with, and strong indications of the existence of copper are furnished. During the remarkable earthquakes of 1812, a fine spring of water at the mouth of the mines suddenly became warm and foul, and in a few days dried up entirely, and no water has run there since. Illuminations

in the atmosphere, (arising doubtless from phosphorus) are frequently observed in this vicinity on the approach of night.

Mine à Burton. There is found adhering to the sides of the Log-hearth furnace at Mine à Burton and other mines, a grayish-white sublimated matter, of great weight, which I take to be a sublimate of lead. It is considered as chiefly sulphur or arsenic by the lead smelters, and is thrown by as useless. It is found at every furnace, and a very large quantity could be annually collected. This circumstance induced me to undertake some experiments on the subject. I was convinced, on reflection, that there could be no sulphur, at least no notable quantity of sulphur in it, from the fact that all sulphur, or other inflammable matter, expelled from the ore in the furnace, would undergo immediate combustion. This is also observable in the colour of the flame while the ore is torrified; and at the same time every person conversant with the nature of this substance must know it cannot be otherwise. The furnace is entirely open, and does not rise over 7 or 8 feet in height, consequently there is no opportunity for it to condense. That the sulphuric acid is driven off, is undoubted, for whenever sulphur is burned this acid is set at liberty, but it has no opportunity for entering into a new combination, within the body of log furnace.

The idea of arsenic in the substance alluded to, is perfectly erroneous, and has originated in an ignorance of the nature of the ores of these mines. It is the *sulphuret of lead*, and not the *arseniate*.

That there is a small portion of silver and antimony in combination with the ore is probable, but they too are mineralized by sulphur. Reflecting on this, I became convinced of the popular error, and to ascertain the point, made the following experiments:

Exp. I. I took a lump of the sublimated matter freed from adhering impurities, and reduced it to the state of a fine powder by pulverizing in an agate mortar and trituration. Of this I mixed 6 parts with 4 of pulverized borax, and a little charcoal, and submitted to the intense heat of a small chemical furnace. On removing the crucible, I found a button of *metallic lead* in the bottom, weighing nearly 4.

Exp. II. Dissolved a quantity of the powdered sublimate in the nitric acid: it effected a ready solution, with violent effervescence. Poured on liquid carbonat of potash until no more precipitate fell. I then collected the precipitate, and washed away the superfluous alkali by clear water, and dried it in the shade. The result was a very fine, and a very white powder, of considerable weight. This was a *carbonat of lead*, (white lead.) With a quantity of the white lead thus made, I mixed linseed oil, and painted a board. The colour was of the most delicate white, and it gave a good body. On inspecting this board several months afterwards, I found the colour inclining a little to yellowish. But perhaps it stands as well as any white lead would, prepared from litharge, by solution in the nitric or acetic acids, and precipitation by carbonated alkali.

Exp. III. Mixed 8 parts of sublimate, with 12 of muriate of soda, and fused in a crucible, with a tight cover, in a high heat. Result, a yellow, hard, heavy, vitrified mass. This was a *muriate of soda and lead*, (*Patent Mineral Yellow.*)

As these experiments indicated a sublimate of lead of considerable purity, I ventured to suggest to several of those engaged in the lead business, the advantages of converting it into pig lead, by a proper treatment with charcoal in an ash or blast furnace. It is difficult, however, to induce people, particularly those engaged in mechanical pursuits, suddenly to relinquish a long cherished theory, and the smelter who has heretofore considered the sublimate as sulphur or arsenic, hesitates in believing it can be lead. If, therefore, nobody profits by my suggestions, it can give me little disappointment, for experience has often given me occasion to remark, that it is the hardest thing in nature to learn an ignorant mechanic a new thing, or to introduce any alteration under the shape of an improvement, among workmen who have been brought up to particular trades, and have been accustomed to look upon themselves as masters in those trades. This has been the cause of much disturbance in manufactories, as well as mines, in this country, as well as in Europe. The first attempt of weaving by steam power, succeeded so well, that the weavers of Manchester (1791) burned down the manufactory. A similar opposition took place on the introduction of the stocking loom.

It is also, perhaps, worthy of inquiry, whether this sublimate of lead is not adapted as a flux in the manufacture of flint glass, where litharge and red-lead are largely employed. In this light alone, it is a subject of some moment. From four to five hundred weight might be collected at every furnace, and as it is constantly forming, perhaps this amount might be collected annually.

M'Kains' Mine is situated on a small stream, called *Dry Creek*, running into Big River not far from its junction with the Merrimack. It has not been worked for several years, and is among the number of those of least extent, which are not considered advantageous. The mine is worthy of remark, only on account of a body of *steel-grained lead ore* found there. This ore is found to yield less lead in smelting than the common broad grained ore, and, as may be inferred from its texture, contains more silver.

Mine à Martin. A quantity of slag is lying here, of a very rich appearance. It is a heavy, black, well melted substance, containing a considerable proportion of lead in the state of an oxyd, mixed with the earthy and alkaline parts of the ore. I consider this a suitable material for the manufacture of glass bottles; it would require but a small addition of alkali and sand, to render it a very fusible and strong glass, fit to be blown into *junk bottles;* and with a due admixture of other materials, it might be employed in considerable quantity in the formation of the lighter coloured *green bottles.* It is found at all the mines, where an ash furnace has been erected; at some places in greater puri-

ty than others, according to the flux which has been employed in smelting the lead ashes. This mine, and Mine La Motte, are particularly noticed for the richness of the slag.

In the manufacture of glass bottles, there is a great variety of materials employed, and indeed as great a variety in the quality of the glass produced. The principal kinds are the *black junk bottle*, and the *common green bottle.* Of these, sand forms the basis, which is rendered fusible by the addition of potash, house ashes, and salt. The sand employed is of the most fusible and impure kind; for as the colour of the ware is not regarded, the more iron or other metallic impurities are combined with it, the easier it will melt, and the better is it adapted for the purpose. Blacksmith's cinders, slag from an iron furnace, and from a glass furnace, and even ashes from which the salts have been partially extracted by lixiviation, are also sometimes employed; the glass-founder always consulting the convenience and cheapness of the material, and adapting his compositions accordingly. Lime in all its combinations, may be advantageously used. In the state of quicklime and chalk, it is a flux of considerable activity, and is largely employed, not only in the manufacture of bottles, but in common window glass. In its combination with the sulphuric acid, (Gypsum,) it is well adapted as a flux; but where a particular regard is had to the purity, as well as the activity of the lime employed, it will be advisable to prepare it from the calcination of marble, or of shells, previously washed clean. This nicety will not, however, be found

necessary in making common bottles, the prices of which will not indeed justify a great expense in the preparation of materials. Wood ashes are found, on analysis, to consist essentially of alumina, silica, calcia, oxyd of iron, oxyd of manganese, and potash. The four last are powerful fluxes for sand, and are, therefore, well adapted as an ingredient of glass. The alkali alone, in fresh burnt house ashes, is reckoned at ten per cent.; when, however, the colour of glass is essential, they cannot be employed, as the iron communicates a green tinge, which, however agreeable in window glass, is objected to in a tumbler or a decanter; but in common bottles, nothing is more suitable—nothing cheaper, or more readily obtained.

There are also several volcanic productions, which have been found particularly adapted to the manufacture of bottles. Such is basalt, which has been largely employed in this manufacture in France; and where it happens to be contiguous to a glass works, is a most valuable material. For this discovery we are indebted to Chaptal, one of the most ingenious chymists of the age. His own remarks on this subject are of so instructive a nature, that they may with propriety be introduced in this place.

"Basalts is converted by fire into a most beautiful black glass. This property, which is admitted by every chymist, induced me to fuse it, and blow it into bottles. The attempt was perfectly successful at the glass-house of Mr. Gilley, of Allais, and at that of Mr. Giral, of Erepian. I still possess the first vessels which were blown of this sub-

stance: they are of the most beautiful black, astonishingly light, but without transparency. Encouraged by this first success, I requested Mr. Castelviel, the proprietor of another glass-house, to undertake some experiments; and in consequence of various trials, we succeeded in fabricating bottles of an olive green, in which the most extreme lightness, and a truly astonishing degree of solidity, were united. *Pounded basalts, soda, and sand*, in nearly equal proportions, formed the composition. The properties of these bottles, as proved by my own experiments, as well as by those which Mr. Joly De Fleury, at that time comptroller-general, ordered to be made, rendered them of the greatest value in commerce; and Mr. Castelveil, was unable to supply the numerous orders he received. This manufactory supported itself with success for two years; but at the end of that time, the superiority of the bottles ceased to be the same: the manufacturer received the reproaches of the consumer; this superb establishment gradually fell off, and was at length abandoned.

" Since that period, I have made several experiments in the large way, from which I have obtained results, that may be of service to such as are desirous of following the manufacture.

" I. The nature of the combustible used in glass-houses, has a prodigious effect in modifying the results of experiments. The same basalts which Mr. Castelveil considered as too refractory in his furnace heated by wood, was found of too fusible a nature by Mr. Giral, who was in the habit of using pit-coal in his glass-works. The former manufac-

turer accordingly made his glass by adding soda to the lava, whilst the latter mixed it with a very refractory sand.

"II. The same lava, fused without addition, may be blown in one glass-house, and not in another. This irregularity appeared to me, at first, to depend essentially on the skill of the workmen; but I have since been convinced, that it is totally independent of that circumstance. In a furnace which is strongly heated, the fused lava becomes fluid like water, and drops from the iron tube, (the blow-pipe,) as soon as collected. The same lava, when fused in another furnace, will preserve a sufficient degree of consistence, to admit of being blown. I am myself well assured, that the lava might be wrought in any glass-house whatever, provided the moment was seized in which the paste was neither too fluid, nor too thick to be wrought; but those attentions are too delicate, and too minute, to be observed in works in the large way.

"III. The hardest basalts affords the most beautiful glass. When it is contaminated with foreign principles, such as the nodules of lime, the glass is brittle, and has not a sufficient connexion of its parts. This circumstance, in my opinion, was the cause of the bad quality of the glass, which produced the failure in Mr. Castelviel's manufactory.

"IV. I have seen very hard basalts interspersed with black infusible points, insomuch that these points became enveloped in the vitreous paste, without any perceptible alteration. The volcanic

mountain of Escandorgue, near Lordeve, afforded me this variety of basalts.

"In the article Verrerie, of the Encyclopédie Méthodique, may be seen the various results which we have obtained with Mr. Allut, in several experiments made in the Royal Glass Works of Bosquet and elsewhere.

"I shall conclude from the observations which my experiments have hitherto afforded,—1. That lava may be used in glass houses to diminish the consumption of soda. This is the single purpose I at that time proposed to myself, and I have clearly accomplished it. 1. By the results of my experiments, which have shown that refractory sand becomes fused in the glass furnace by a mixture of lava. 2. By the effects obtained in all the works in the large way, in which the addition of lava permitted a diminution in the proportion of soda.

"2. It was very difficult to establish a rigorous process, applicable to all circumstances, by which lava may be wrought without addition. My bottles, into which lava entered as a component part, were scarcely known, before it was published that they were formed of lava without addition; nothing more being said to be required than to fuse the lava in order to form bottles. This strange report affected me very little in the principle, because I had neither spoken, written, nor printed any thing which was capable of giving authority to such an error; and I was content to reply to all persons who demanded information, by informing them, that experience had taught me that an addition of lava diminished the proportion of soda in the com-

position of glass, and that this new principle rendered the bottles lighter and stronger.

"3. That the only advantage which can be derived from fusing lava without addition, is to pour it out into moulds, to form paving stones, chimney jams, &c. The facility with which it is fused by the assistance of pit coal, would render these works of small expense, and it might easily be decorated by incrusting it with metallic colours.

"4. That the difference in the nature of volcanic products produces such a variety in the results of their fusion, that I consider it as impossible to assign a constant and invariable process, by which the same result may be infallibly obtained. This circumstance renders it necessary to make preliminary trials in all cases where it is intended to use basalts in the fabrication of bottles."—(*Chaptal's Chymistry.*)

It may not be uninteresting also to give the results of some experiments of M. Alliot, on different mixtures of this basaltic earth. Seven crucibles with different mixtures were heated for 18 hours in a common potter's furnace, (a glass-house not being at command,) which however gives a less intense heat than the glass furnaces, and therefore, if used in manufacture, a greater effect might be allowed than was here noticed. The results were the following:—

No. 1. Contained pure basaltic earth, and melted into a black opaque glass, moderately well melted.

No. 2. Was a mixture of one third basalt, one third of ashes, and one third of white quartz in

powder. It was a milky, brilliant, coffee-coloured glass, resembling fine porcelain.

No. 3. Was a mixture of equal parts of basalt, and common sand. It was moderately well melted, of a blackish blue in mass, but in thin lamina was of a yellow green.

No. 4. Was a mixture of equal parts of ashes, and a volcanic granite. It melted well, gave a very fine dark yellow glass, of great lustre, and would have been very proper for bottles.

No. 5. Contained one-nineteenth of ordinary soda, six-nineteenths of common sand, and twelve-nineteenths of ashes, and gave a yellow black glass, interspersed with opaque bluish white veins.

No. 6. Consisted of one-third of basalt, one-third of refuse soda, and one-third of sand. It gave a fine transparent green yellow glass, very well melted, of a fine polish, and which would have been excellent for bottles.

No. 7. Was simply the sand of the river Orb in the neighbourhood, which appeared by inspection to contain a large portion of basaltic earth. It melted well, and gave a very good bottle glass.

The analysis of basalt shows that it is very well fitted both for fusion *per se*, and to act as a flux of considerable power; for it consists of about 45 per cent. of silex, 16 of alumine, from 6 to 20 of oxyd of iron, 9 of lime, and from 2, 6, to 4 of pure soda, of which the three last are all very powerful fluxes. Many other minerals contain even more soda, such as the *Klingstien*,* which contains about 8 per cent. of this alkali, but having much less lime and oxyd of iron, it is much less fusible. The

* Clinkstone of Cleaveland.

colour of all the glasses into which basalt enters largely as a constituent, is generally of a deep olive green passing into deep yellow, and in mass almost yellow, nor is it probable that this colour could be materially corrected. The glass is well ascertained to be specifically lighter, and at the same time tougher than common green bottle glass, so as to bear harder blows without breaking—two very important advantages; and the quantity of alkali contained, and that required to bring the whole to a workable state, is so small as probably to enable this glass to resist all corrosive liquors, at least as well as any known kind of glass. (*Artist's Manual.*)

In the different volcanic products, the Missouri Territory abounds. Pumice is annually brought down by the waters of the Missouri, and when they subside, pieces of it are to be picked up all along the shores of the Mississippi. It is also found in the interior, on the dividing ground between White and Strawberry rivers, and volcanic mountains are reported to exist on the waters of the Kanzas, La Platte, and Yellow stone rivers. On the latter we are informed of a volcanic mountain, which is continually emitting smoke and flames, and lava is the product of that neighbourhood; but on this interesting head we have much to expect from the expedition, which is now ascending the Missouri, to establish a garrison at the mouth of the Yellow Stone.

The Yellow Stone River is one of the most considerable tributary streams of the Missouri. It originates in the spurs of the Rocky Mountains,

near the sources of the Arkansaw, and after running nearly 800 miles in a N. E. course, enters the Missouri 1800 miles above its mouth. The Yellow Stone, in its course to the Missouri, is swelled by innumerable streams, the principal of which are *Tahong River*, *Big Hoen*, and Republican Fork, all affording lands of the richest quality. It is represented as drawing its waters from a country as fertile, varied, and extensive, as the valley of the Ohio, and one capable of supporting as numerous a population.

SECTION IV.

Method of Working the Mines.

The method of raising the ores, and the processes pursued in separating the metal, are, upon the whole, extremely simple. A pick axe and shovel are the only tools in use for removing the earth, and the drill, rammer, and priming rod are added when it is necessary to blast. Having determined on the spot for digging, the process commences by measuring off a square of about 8 feet, and throwing out the earth, spar, and gravel, until the miner sinks beneath the depth he can throw the earth. A practised hand will pitch his earth clear out of the pit from a depth of 10, 12, and even 15 feet. At this depth a common windlass and bucket is placed over the centre of the pit, and the digging continued by drawing up the earth, spar, and ores, if any are found, in the manner pursued in sinking a well. During his progress the miner is notified of his approach to a body of ore, by small detached lumps occasionally found imbedded in the soil, within a few feet of the surface, and sometimes lumps on the top of the ground determine on the place for digging. The spar is also a sign by which he judges, and there is seldom a body of spar found, without lead ore. There are also other signs, by which an experienced digger is advertised of his prospects, and encouraged to

proceed with cheerfulness in his work. These are, peculiar appearances in the texture of the spar, and sometimes minute specks of ore scattered through it, the changes in the colour, and other qualities of the earth, gravel, &c. If these appearances are promising, and bits of ore are occasionally met with, he is encouraged to sink down a great depth; but if they should fail, he is generally induced to abandon the pit, and commence at another place.

In searching for ore, the soil, the slope of the hills, spar, *blossom**, trees, &c. are taken as guides, and some are obstinately attached to these signs. Others, who have been fortunate in finding ore where these appearances were least promising, wholly disregard them, and pay no attention to rules. In general, there is a greater disposition to trust to luck and chance, and stumble upon ore, than by attending to mineral character, to be sure of success. As those who hunt by rules, are generally incapable of those minute remarks on the distinguishing character, and geological situation of minerals, which are necessary, in order to ensure success; it frequently happens that such meet with disappointments. An incident of this kind, is enough to perplex a man who has not habituated himself to reasoning on the subject, and to weaken his belief in the affinity of ores and stones. Such a man will not stop to compare and reconcile facts, which are seemingly opposite, or to investigate the nature of chymical principles, attraction, repulsion, decomposition, &c.

* Radiated quartz of Mineralogy.

Hence I frequently hear miners exclaim on the uncertainty of finding ores by rules drawn from the observations of science; that the strata of the earth are irregular, and not to be depended upon like the rock formations in Europe; and that in fine, we have no guides by which its mineral treasures are to be sought, and that in so confused a soil, chance is the best guide. Such a man is more ready to follow the mysterious guidance of the *divining rod*, than the light of reason; and would be easily persuaded that fortune is more surely the result of blind chance, than of feasible schemes well planned, and well executed.

There may, nevertheless, be some truth in the uncertainties and the confusion complained of, and were those circumstances among the observations of scientific men, would be conclusive. But who has ever explored Missouri with a geological eye? What mineralogist has ever travelled the country to make a collection of its numerous fossils? or what chymist has ever analyzed its mineral and vegetable productions? I know of none; it is a boundless field on which the light of science has but partially dawned; but it will be hazarding little to say, that when such observations are made, there will be found as much regularity, harmony, and order in the works of nature, as generally exist. The few facts I have noticed, lead to this conclusion. It affords *granite*, *gneiss*, and *mica-slate*, all rocks of the oldest formation. The whole mineral country is bottomed on *primitive limestone*, and quartz rock, and the older sand rock, are very common in the southern section, in the Arkansaw

country. Secondary limestone is met with, but it is far less common than in Ohio, Indiana, Kentucky, and Illinois, and when found, is to be traced overlaying *transition* or *primitive* rocks. Such is its situation on the Mississippi, at the *Dormant Wall*, and at the cliffs in the neighbourhood of Herculaneum. Hence we are led to infer the antiquity of its geological character, and cannot resist the belief, that few districts of the old world afford a greater regularity or harmony in their earthy structure; and if miners would render themselves acquainted with the pursuits they follow, if they would study the principles of their business, they would no longer find their operations a continued series of doubts, perplexities and disappointments.

Having raised a sufficient quantity of ore for smelting, the next process consists in separating the spar, and cleaning the ore from all extraneous matter. This is done by small picks tapered down to such a point, that a careful hand may detach the smallest particle of adhering spar. It is necessary that the ore should be well cleaned, for it would otherwise prove refractory in smelting. If there be any lumps of uncommon size, these are beaten smaller. The object is to bring the lumps as near as may be to an uniform size, so that the heat may operate equally in desulphurating the ore. It is desirable that the lumps should be about the bigness of a man's two fists, or about fifteen pounds weight: if too small, a difficulty and a waste is experienced in smelting. In this state the ore is conveyed to the furnace, (see Plate I.) and piled on the logs prepared for its reception.

When the charge is put in, which may in a common way be about five thousand pounds, it is surrounded by logs of wood, and covered over at the top, and the fire is lit up at the mouth below. A gentle warmth is given at first, which is raised very gradually, and kept at this point for about twelve hours, to allow the sulphur to dissipate; the heat is then increased for the purpose of smelting the ore, and in twelve hours more, the operation is completed, and the lead obtained. Wood is occasionally added as the process goes on, and there is a practical nicety required in keeping the furnace in proper order, regulating the draught of air, &c. so that some smelters are much more expert, and thereby extract a greater quantity of lead from a like body of ore, than others. This furnace is called the *Log Furnace*, and so far as I know, is peculiar to this country. It is of very simple construction, consisting of an inclined hearth, surrounded by walls on three sides, open at top, and with an arch for the admission of air below; and upon the whole, it appears well adapted to the present situation and circumstances of the people. It is cheap, simple, may be built at almost any place, and answers the purpose very well. A good furnace of this kind may be built at an expense of from fifty to sixty dollars, every expense considered, and one of the most considerable items in this is the mason's bill, who cannot be hired to work here, for less than two dollars a day.

Log Hearth Furnace

No. 1.

Fig. I.

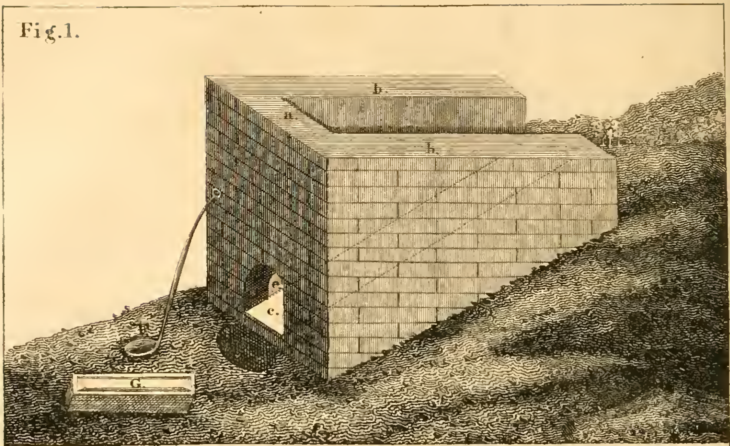


Fig. II.

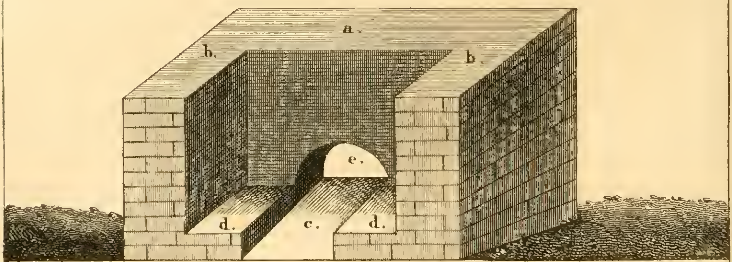
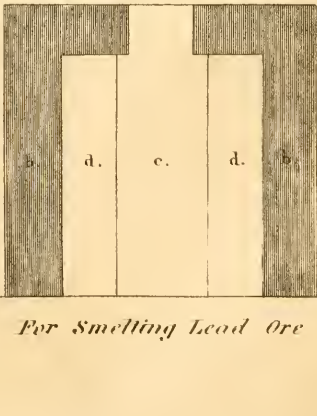


Fig. III.



R. Schoolcraft. Del. *J.D. Stout. Sc. N. York.*

For Smelting Lead Ore

Plate I. Figure 1. is a perspective view of the Log Furnace.

a. The front wall, 8 feet long, 7 feet in height, and 2 feet in thickness.
b. b. The side walls, 8 feet long, and 2 feet thick.
c. The hearth, 2 feet wide, and 8 feet in length.
d. d. The ledges on each side of the hearth, 10 inches in height, and 1 foot wide. These serve to elevate the logs above the hearth, at the same time creating a draught for the air, and a passage for the lead.
e. The eye of the furnace, or arch, 2 feet across at bottom, with an arch thrown in a half circle, or a flat stone laid across at the height of the ledges.
f. The iron ladle for dipping out the melted lead.
g. The iron mould. Every bar of lead cast in this, is called a *pig*.
h. The hole in the ground, for the reception of the lead as it runs from the furnace.

Figure 2. a perspective view of the furnace from the back or open part. The same letters used in Fig. I. apply to the same parts of the furnace in this figure.

Figure 3. Ground plan.

a. The eye or arch in front.
b. b. The side walls.
c. The hearth.
d. d. The ledges.

Three large oak logs rolled in from the back side, and resting on these ledges, on each end, fill up the width of the furnace; small split logs are then set up all around on the two sides and front; the ore is then piled on, until the furnace is full, and logs are then piled over it, beginning at the back, and continuing over to the front, so that the ore is completely surrounded by wood. This furnace is always built on the slope of a hill, as represented in Plate I. Fig. I. and the hearth is laid on an angle of 45°. so that it falls four feet in a distance of eight. Two furnaces of the size here described, are generally built together, by which there is a saving made of the expense of one wall, and the work is rendered stronger, one serving as a support to the other. Not only so, the same number of hands will keep a double-eyed furnace in blast, which are required at a single one. It takes three hands, one to cart wood during the day time, and the other two to relieve each other alternately, every twelve hours, at the furnace. When a charge is melted off, the furnace is cooled, new logs and upright pieces put in, and the whole operation began anew. Twenty-four hours is the time generally allotted for each smelting, but it often takes thirty-six, and when there is bad wood and want of attention, it requires still longer, and indeed the result is never so good.

The ore is estimated to yield in the large way, fifty per cent. the first smelting. A considerable portion of what is put in, does not, however, get completely desulphurated, and is found in the bottom of the furnace after cooling. This is chiefly

the smallest lumps, which have fallen through the apertures that burn between the logs, before they were thoroughly roasted, and thus getting out of the way of the heat, lie entangled with the ashes. Some lumps which are too large, also escape complete desulphuration, and either remain unmelted, or else, when the fire is raised, melt altogether, into a kind of slag, and produce little or no metallic lead. This constitutes what are called the *lead ashes.* The larger pieces, consisting of ore but partially desulphurated, are carefully picked out from among the ashes, and added at the next smelting in the log furnace; the remainder is thrown by in heaps for further examination.

The *lead ashes* are still rich in lead, and when a sufficient quantity has accumulated from repeated smeltings, it is taken off to a proper place contrived for the purpose, and separated from the cinders, wood-ashes, and other adhering impurities. This is done by washing the whole in *buddles*, one set below another, in the manner of the potter, when it is necessary to *search* his clays. The ashes, which consist of clotted lumps of a moderate hardness, are first pounded to a gross powder, and then introduced into the water through a sieve. The wood-ashes, and other impurities being lighter, swim on the top, and by letting off the water, are thus carried away. Fresh water is added, the ashes briskly stirred with a hoe, and the water again let off, carrying a further portion of impurity with it, and by repeating this operation several times, the lead ashes are brought to the required degree of purity. Thus washed, they are carried to a furnace

of a different construction, called the *Ash Furnace*, (see Plate 2.) and undergo a second smelting.

Plate II. Figure 1. A perspective view of the Ash Furnace.

a. The ash-pit, 2 feet wide, 6 feet long, and 20 inches in height.
b. The mouth of the fire-arch, a foot square.
c. The mouth of the flue, where the charge is put in.
d. The iron pot for the lead to flow in, when the furnace is tapped.

Figure 2. A longitudinal section through the furnace at right angles with the front, showing the curve of the arch, flue, &c.

a. The ash-pit.
b. The grates, 10 inches square, and 3 feet long; these are pieces of hewn stone.
c. The mouth of the fire arch.
d. The *santee*, consisting of two stones, 3 feet long, and 3 feet 6 inches wide, with a thickness of 6 or 7 inches. They reach from the bottom of the ash-pit, to a foot above the basin-stone, the interstice between them being rammed full of clay, and the whole measures 18 inches across. (This keeps the lead, slag, &c. from running into the fire arch, and is an important part of the furnace, requir-

ing considerable skill and accuracy in the construction.)

e. The basin-stone, 4 feet square, and 1 foot thick.

f. The flue, or throat, 10 feet long, 22 inches wide, and 11 inches in height. This must be continued a foot and an half over the mouth of the flue, or apron, making the whole length eleven and a half feet, some prefer the flue twelve and a half feet.

g. The mouth of the flue or apron, where the furnace is charged; this flares from 22 inches to 3 feet in a distance of 3 feet, (as shown in Fig. 3.)

h. The fire arch, 3 feet high in the centre, 18 inches high where the arch begins to spring, and the same over the centre of the basin stone.

Figure 3. Ground Plan.

From *a* to *b*, 8 feet; from *b* to *c*, 8 feet 6 inches from *a* to *d*, 8 feet 6 inches; from *e* to *f*, 6 feet; from *e* to *g*, 13 feet.

h. The basin, 4 feet long, and 22 inches wide, except in the centre, where it is 24 inches wide.

i. The flue.

k. The mouth of the flue, or apron, 3 feet at the front, and 22 inches in rear.

l. The santee.

m. The fire-arch, with grates at bottom; (this is 22 inches wide at each end, 24 inches in the

centre, and 5 feet long from the inside of its mouth to the santee.)

n. The mouth of the fire arch.

o. The iron pot for the lead to flow into, set in the curve made in the wall for convenience of tapping.

p. The curve in the wall for drawing off the slag.

Figure 4. A perspective view of the mouth of the flue where the furnace is charged.

From *a* to *b*, 6 feet; from *a* to *c*, 5 feet; from *a* to *d*, 1 foot.

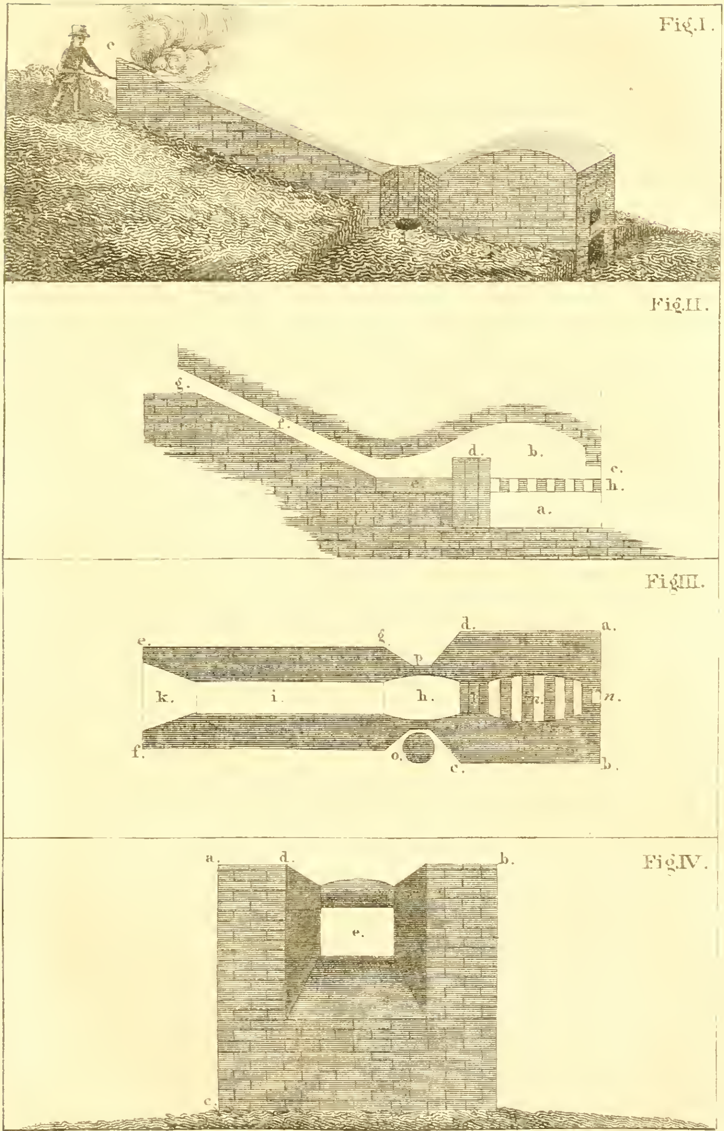
e. The mouth of the flue 22 inches wide, and 11 high. (This flares out to 3 feet in the distance of three feet, the flue covering half of it, so that the heat may be thrown down on the ashes.

One of the principal points to be attended to in building an ash-furnace, is the elevation of the flue. It should rise $5\frac{1}{2}$ feet in 10: some prefer $5\frac{1}{2}$ in 11. If the ascent be too steep, the ore will run down into the basin before it gets hot, which is detrimental. If the ascent be too low, the bottom of the flue next to the basin will soon cut away by the heat, and thus in a short time undermine, and destroy the furnace.

The flux employed is also a matter of moment. Sand, and pulverized flinty gravel, are mixed with the lead ashes before smelting. The object of this is to promote the vitrification of the slag, which would otherwise remain stiff; the particles of revived lead would not sink through to the bot-

Ash Furnace

N°2.



H.R.Schoolcraft Del — J.D.Stout Sc. N.York.

for Smelting Lead Ashes; Missouri.

tom, but remain entangled with it, and thus be lost Lime is also sometimes employed for the same purpose, and indeed any earth would operate as a flux to the scoriacious part of the lead ashes, if added in a due proportion, particularly the alkaline earths. Lime and barytes, both of which are afforded in plenty at the mines, might therefore be advantageously employed, when no sand or easy-melting silicious gravel could be obtained. Good fusible sands are readily attacked, and liquified by submitting to heat with oxydes of lead, alkaline salts, or any other alkaline or metallic flux; hence their extreme utility in glass, enamels; and all other vitrescent mixtures. When, therefore, silicious sand is to be obtained, it will be found a more powerful flux to lead ashes than either gravel, lime, spars, or any other substance, if we except the fluor spar. This is probably better adapted as a flux than even silicious sands, but it has not yet been brought to light at the lead mines. Perhaps the lower strata of the earth may afford it. It is found at a lead mine near Cave-in-Rock, on the right bank of the Ohio river, State of Illinois, and, with the exception of a little found at Northampton, Massachusetts, is the only place where this rare, useful, and beautiful mineral occurs in the United States*.

* I was mistaken in supposing this the only locality of the fluate of lime in the United States. It has also been found "in *Virginia*, near Woodstock or Miller's town, Shenandoah Co. in small loose masses in the fissures of a limestone containing shells. (Barton.)—In *Maryland*, on the west side of the Blue Ridge, with sulphate of barytes. (Hayden.)—In *New-Jersey*, near Franklin Furnace, in Sussex Co. disseminated in lamellar carbonate of lime, and accompanied with mica and carburet of iron;—also near Ham-

The situation for an ash furnace is always chose on the declivity of a hill, as represented in the plate. The inside work, or lining, consists of slabs of hewn limestone, laid in clay-mortar, and backed by solid masonry. Although a stone less adapted for furnaces could hardly be found, yet it is made here to answer the purpose, and is an evidence of the ingenuity of men in making a bad material answer when a good one cannot be found. No sand stone or free stone of that refractory kind used in glass and iron furnaces is afforded in this vicinity, and the smelters seem to prefer building their furnaces often, to incurring the expense of transporting good infusible sand stones from a distance. It is not perhaps duly considered, that a furnace built of refractory materials, although expensive in the erection, would be sufficiently durable to warrant that expense, and outlast several built of limestone which burn out every blast, and are obliged to be rebuilt from the foundation.

Limestone is a combination of the pure earth *lime* with *carbonic acid* and *water*; it is a *carbonat of lime*. When subjected to a red heat, it parts with its carbonic acid and water, and if the operation be continued long enough, is converted into quick-lime. This effect, therefore, takes place as well in

burg, in the same Co. on the turnpike to Pompton, in a vein of quartz and feldspar. (Bruce.)—In *New-York*, near Saratoga Springs, in limestone; it is nearly colourless, and penetrated by pyrites.—In *Vermont*, at Thetford.—In *Connecticut*, at Middletown, in a vein, and is accompanied by sulphurets of lead, zinc, and iron. (Bruce.)—In *Massachusetts*, at the lead mine in Southampton, where it is imbedded in sulphate of barytes, or granite; its colours are green, purple, &c.—In *New Hampshire*, at Rosebrook's Gap, in the White Mountains, in small detached pieces. (Gibbs.)"

Cleaveland's Mineralogy.

the lead furnace as in the lime-kiln, and with this difference only, that in the former it is laid in a wall, protected in some degree from the heat, and will not part with its carbonic acid readily; while in the latter, it is broken into comparatively small lumps, exposed to the heat on all sides, and is easily and readily converted into quicklime.

Nevertheless, although this calcination is constantly and slowly progressing, an ash furnace will last from 15 to 20 days, according to the skill which has been displayed in its construction, and the particular quality of the stone employed. When the stone partakes of clay (alumina) it runs into a variety of *argillaceous limestone*, and is manifestly better adapted to resist the effects of fire. Whenever the furnace is cooled, so that the stone can attract moisture from the atmosphere, it falls into quicklime. This change does not, however, take place rapidly, for the burning has seldom been uniform, and the stones have either been *overburned* or not burned enough, so that it requires several days, and even weeks, to assume the powdery state.

An ash furnace, built of limestone, is estimated to cost $100. This includes every expense, and such a furnace lasts during one blast, say 15 or 20 days; perhaps with great care it will run a month; and during this time from 60 to 90,000 lbs. of lead ought to be made.

When a furnace is completed, it requires several days to dry it, and bring it to the proper state for smelting. About 10 days are usually spent in this. The fire is begun very moderately at first, being

only the warmth of a hot smoke, and is kept so for the first 5 days, by which means the moisture of the mortar and stone is gradually expelled, and without any danger of cracking the stone, or otherwise injuring the furnace. It is then raised a little every day until the furnace is brought up to a full red heat, when it is ready for the first charge of ashes.

The operation begins by shovelling a layer of ashes on the mouth of the flue, then adding a thin layer of sand or flinty gravel as a flux, and then more ashes; and so adding ashes and gravel alternately until the required quantity is shovelled up. This is suffered to lie here and grow thoroughly hot before it is shoved down the flue into the basin, for if introduced cold, it would check the heat too suddenly, and prove injurious in the result. When hot, the charge is shoved down the flue with a long handled iron hoe, and another portion of ashes and gravel immediately shovelled on the mouth, suffered to heat, and then pushed down as before. This operation of heating and charging is continued until the furnace has a full charge, which may require about 6 hours, and in two hours more the furnace is ready for tapping. The slag, which is in a very fluid state on the top of the lead, is first drawn off, and the aperture closed up with stone and mortar. The smelter then goes to the opposite side of the furnace, and prepares for drawing off the lead by driving a stout sharp pointed iron bar through the side of the furnace, at a particular place contrived for this purpose. On removing the bar, the metallic lead flows out

into a large iron pot set in the ground, and accompanied by a considerable quantity of a semi-metallic substance, called *zane.* This is lead not perfectly revived, being combined with some earthy particles, and oxyd of lead. The zane occupies the top of the pot, and is first laded out into hemispherical holes dug in the clay near by. This substance is of the consistence of the prepared sand used by brass founders when hot, but acquires considerable solidity when cold. The metallic lead is then laded into iron moulds of about eighteen inches in length, and yielding a pig of lead of about fifty pounds each. The quantity of zane made at each tapping, is about equal to that of metallic lead. This is afterwards taken to the log furnace, and readily converted into lead. The lead made at the ash furnace is not thought to be of so pure a quality, as that of the first smelting made at the log furnace. It undoubtedly contains the silver, antimony, and other metals, (if any,) combined with the ore, and is therefore more refractory. Such lead is thought to be a little harder, and some pretend to discover a lighter colour.

The lead ashes are reckoned to yield fifteen per cent. of lead, (zane and all,) which, added to the first smelting, makes an average produce of sixty-five per cent. This estimate will hold good uniformly, when the ores have been properly dressed, and the smelting well performed. Any spar adhering to the ore, renders it refractory, so does blende, and pyrites. The latter is particularly in-

jurious, as it consists chiefly of sulphur, a substance known to render all ores refractory.

The slag created by the ash furnace, is a heavy, black, glassy substance, well melted, and still containing a portion of lead. Some attempts have been made, to obtain a further portion of lead from it, by smelting with charcoal in a blast furnace; but the undertaking has not been attended with complete success, and is not generally thought to warrant the expenses. The per cent. of lead recovered from the slag is not estimated over ten, and with the utmost success, cannot be reckoned to overgo twelve.

Metallic lead in the pig, is now, (Feb. 1819.) worth $4 per cwt. at the mines. It sells for $4 50 on the banks of the Mississippi, at St. Genevieve and Herculaneum; for $5 50 in New-Orleans; and is quoted at $6, in Philadelphia. This is lower than has ever been known before, (except at one period,) and a consequent depression in the mining business is felt. There is a governmental duty of one cent per pound, on all bar and pig lead imported into the United States, but it does not amount to a prohibition of foreign lead from our markets. Perhaps such a prohibition might be deemed expedient. It is what the lead smelters here call for, and certainly the resources of this country are very ample, not only for supplying the domestic consumption, but for *exportation.*

Those who dig the ore do not always smelt it. The merchants are generally the smelters, and either employ their own slaves in raising the ore,

or pay a stipulated price per *cwt.* to those who choose to dig. For every hundred pounds of ore, properly cleaned, the digger receives two dollars. He works on his own account, and runs the risk of finding ore. It is estimated that an ordinary hand will raise a hundred weight per day, on the average, of a year together. This depends, however, much upon luck; sometimes a vast body is fallen upon, with a few hours labour; at others, many weeks are spent without finding any. He who perseveres will, however, generally succeed, and the labour bestowed upon the most unpromising mine, is never wholly lost. The above average has been made by those long conversant with the business, and upon a full consideration of all risks.

Custom has established a number of laws among the miners, with regard to digging, which have a tendency to prevent disputes. Whenever a discovery is made, the person making it, is entitled to claim the ground for twenty-five feet in every direction from his pit, giving him fifty feet square. Other diggers, are each entitled to twelve feet square, which is just enough to sink a pit, and afford room for throwing out the earth. Each one measures and stakes off his ground, and though he should not begin to work for several days afterwards, no person will intrude upon it. On this spot he digs *down*, but is not allowed to run drifts *horizontally* so as to break into, or undermine the pits of others. If appearances are unpromising, or he strikes the rock, and chooses to abandon his pit, he can go on any unoccupied ground, and ob-

serving the same precautions, begin anew. In such a case, the abandoned pit may be occupied by any other person, and sometimes large bodies of ore are found by the second occupant, by a little work, which would have richly rewarded the labours of the first, had he persevered.

In digging down from fifteen to twenty feet, the rock is generally struck, and as the signs of ore frequently give out on coming to the rock, many of the pits are carried no further. This rock is invariably limestone, though there are many varieties of it, the texture varying from very hard and compact, to soft and friable. The former is considered by the diggers as a *flinty stone*, the latter is called *rotten limestone*, and from its crumbling between the fingers, and falling into grains, there is a variety of it called *sand stone.* It is all, however, a calcareous carbonat, will burn into quick-lime; and, as I find on experiment, is completely soluble in the nitric acid. As no remains or impressions of shells, animalcula, or other traces of animal life, are to be found in it, I conclude it to be what geologists term *primitive limestone*, a conclusion which is strengthened by its irregular form. It exhibits no regular strata, being always found in huge mis-shapen masses. How far this formation extends, it would be difficult to determine, but so far as my observation goes, it is invariably the basis on which the mineral soil at Mine à Burton, and the numerous mines in its vicinity, reposes. It passes into *transition* and *secondary* limestone in various places on the banks of the Mississippi, between Cape Girardeau and St. Louis. It is also seen passing into

a variety of marble, on the bluffs immediately back of Herculaneum, and at Judge Bent's plantation three miles below St. Louis. I have seen no specimens of this mineral, however, which can be considered as a valuable material in sculpture.

I have already mentioned the per cent. of lead obtained in smelting in the large way. I shall here add the result of an assay made on the ore. One hundred parts of ore yielded as follows:

Metallic lead	82
Sulphur driven off by torrefaction	11
Earthy matter, and further portion of sulphur, either combined with the scoria, or driven off by heat	7 by estimation.
	100

The ore experimented upon, was the common ore of Mine à Burton, (*galena.*) I took a lump of the purest ore, completely freed from all sparry and other extraneous matter, beat it into a very gross powder, and roasted for an hour and a half, in a moderate heat, with frequent stirring. On weighing the mass, it had lost 11 of sulphur. I now beat this to a very fine powder, and treated it with a strong flux of nitre and dry carbonat of soda, adding some iron filings to absorb the last portions of sulphur. The whole was enclosed in a good Hessian crucible, previously smeared with charcoal with a luted cover; and exposed for twenty minutes, to the high heat of a small chymical blast furnace.

The richest species of galena of which we have any account, is that of Durham, England. An analysis of a specimen of this ore by Dr. Thompson, gave the following result:

Lead	85 13
Sulphur	13 02
Oxyd of iron	0 5
	98 65

Many of the English, and nearly all the German ores are, however, much poorer. Of five several experiments made by Vauquelin on ores from different mines in Germany, sixty-five per cent. of lead was the richest, and all were united with uncommon portions of carbonated lime and silex.

The button of metallic lead found at the bottom of the crucible in chymical assays, contains also the silver, and other metals, if any are present in the ores. So also in smelting in the large way, the pig lead is always united with the other metals. When ores of lead contain any notable portion of silver, they assume a fine steel grain, and the crystals, which are smaller than in common galena, oftener affect the octohedral, than the cubical figure. They are also harder to melt, and the lead obtained, is not of so soft and malleable a nature, as that procured from the broad grained, easy-melting ore.

The proportion of silver in lead varies greatly. It is sometimes found to yield as high as twelve per cent. and is then called *argentiferous lead-glance*, but in the poorest ores, it does not yield more than one ounce out of three hundred. To separate the

silver from the lead, a process is pursued, called the refining of lead, or cupellation. This is effected by exposing the lead to a moderate heat in a cupell, and removing the oxyd as soon as it forms on the surface, until the whole is calcined, leaving the silver in the bottom of the cupell. The lead in this process is converted into *litharge*, the well known substance of commerce; and the silver is afterwards refined by a second process, in which the last portions of lead are entirely got rid of. This process is known at the German refineries under the name of *silber brennen*, burning silver.

The rationale of cupellation, is simply this. Lead on exposure to heat with access of air, is covered by a thin *pellicle* or *scum*, called an *oxyd;* and by removing this, another is formed, and so by continuing to take off the oxyd, the whole quantity of lead is converted into an oxyd. It is called an oxyd, because it is a combination of lead with *oxygen*, (one of the principles of air and of water.) By this combination, an increase of weight takes place, so that a hundred pounds of bar lead converted into the state of an oxyd, will weigh as much over a hundred, as the weight of the oxygen which it has attracted from the atmosphere. Silver, however, on being exposed to heat in the same situation, cannot be converted into an oxyd; it has no attractive power for oxygen. Hence, when this metal is contained in a bar of lead, the lead only is oxygated on exposure in a cupell, whilst the silver remains unaltered, but constantly concentrating and sinking, till the lead is all

calcined. This is known to a practised eye, by the increased splendour assumed by the metal.

I do not think the ore of Mine à Burton contains a sufficient quantity of silver, to render the separation an object. This is to be inferred from its mineralogical character, from the mathematical figure and size of the crystal, its colour, splendour, &c. The territory is not, however, deficient in ores which are valuable for the silver they contain. The head of White River, the Arkansaw, the Merrimack, and Strawberry Rivers, all afford ores of lead, the appearance of which, leads us to conclude they may yield silver in considerable quantity. Decisive experiments have only been made upon that from Arkansaw; and upon the whole, it is a subject upon which I can say little from my own experiments, or my own observation.

SECTION V.

Annual Produce, and number of hands employed.

On this head, I find it very difficult to procure proper information. The desultory manner in which the mines have been wrought, and the imperfect method in which accounts have been kept, when kept at all, with other circumstances, which are in some measure incidental to the operations of mining in a new country, oppose so many obstacles in the way of obtaining the desired information, that I find it impossible to present a correct statement, from authentic sources, of the annual produce of the mines, for any series of years. When Louisiana was first occupied by the United States, *Mine à Burton*, and *Mine La Motte*, were the principal mines wrought; but the few Americans who had emigrated into the territory, under the Spanish government, were fully aware of the advantages to be derived from the smelting of lead, and, united to the emigrant population which shortly succeeded, made many new discoveries, and the business was prosecuted with increased vigour, and to a much greater extent. The interior parts of the country, and such as had before been deemed dangerous on account of the savages, were now eagerly explored; and

the fortunate discovery of several immense bodies of ore near the surface of the ground, whereby the discoverers enriched themselves by a few days labour, had a tendency greatly to increase the fame of the mines, and the number of miners. But, as it generally happens in new countries, among the number of emigrants, were several desperate adventurers, and men of the most abandoned character. Hence the mines soon became the scene of every disorder, depravity, and crime, and a common rendezvous for renegadoes of all parts. It is by such persons, that many of the mines were discovered, and several of them wrought; and it is, therefore, no subject of surprise, that on inquiry, no accounts of the quantity of lead made, and the number of hands employed, are to be found.

To secure the public interest, and remedy, in some degree, the irregularities practised at the mines, a law was passed in Congress a few years after the cession of Louisiana, reserving all lead mines, salt springs, &c. which should be discovered on the public lands subsequent to that period; and the governor of the territory was, at the same time, authorized to grant leases to discoverers for *three years.* The great defect of that law appears always to have been, that a specific agent was not at the same time authorized to be appointed for the general superintendence, inspection, and management of mines,—an office which, from its nature, can never be properly incorporated with that of the territorial executive, and which, with every inclination, it is presumed his other avocations would prevent him from discharging either

with usefulness to the public, or satisfaction to himself. But whatever be the defect of the law, certainly the advantages which the government proposed to derive from it have not accrued. No revenue, it is understood, has yet been realized under it, and we are now as much at a loss how to arrive at a true statement of the mineral produce of Missouri, as if the mines had never been a subject of governmental legislation.

When a discovery of lead has been made, the miners from the neighbouring country have flocked to it, and commenced digging as usual, no one troubling himself about a lease, and thus the pro visions of the act have been in a great measure disregarded. Men of respectability, and of sufficient capital to carry on mining in a systematic manner, have, it is believed, been frequently deterred from making applications for leases, from the *short period* for which only they can be granted. It would not warrant the expenses of sinking shafts, erecting permanent furnaces, galleries, and other works necessary for prosecuting the business to advantage; for, no sooner would such works be erected, and the mines begin to be effectually wrought, than the expiration of the lease would throw them into the hands of some more successful applicant.

But, although we have no data to form an authenticated schedule of the annual product of the mines, for any required number of years, there is something to be obtained by collecting and comparing facts, detached and scanty as they are. Something also is to be acquired by consulting the

books which have been kept for late years in the ware houses on the Mississippi, where the lead is sent for exportation, and some information is also to be gleaned from various other sources. It is from information thus obtained, that I proceed to an enumeration of the products of the different mines, and the number of persons to whom they furnish employment and support, satisfied at the same time, that although the information may not be *all* that could be desired, yet it is all, which, without the most extraordinary exertions, could be obtained.

The amount of crude ore delivered at the furnaces of *Mine Shibboleth*, during one of its most productive years (1811) was something rising of 5,000,000 of pounds. The ore of this mine is estimated to yield, in the large way, from 60 to 70 per cent.; reckoned at 62½, which is probably a fair average. The product of that mine in 1811 was *three millions, one hundred and twenty-five thousand pounds.* Shibboleth is, however, one of the richest mines in the Territory, and this is the product of one of those years in which it was most profitably worked. It was then a new discovery, vast bodies of ore were found near the surface, and the number of miners drawn together by the fame of its riches, was uncommonly great. It has since declined, although the ore is constantly found; and I am informed by Col. Smith, the present proprietor, that the product this year (1819) will be about one million of pounds.

The number of persons employed in digging lead at Mine à Burton has been constantly lessen-

ing for the last 4 or 5 years; and this celebrated mine, which has been worked without interruption for more than 40 years, and is stated to have yielded as high as *three millions per annum*, is manifestly in a state of decline During the last summer, (1818) the greater part of which I resided at that place, there were not more than 30 miners employed, and the total product of the different pits, shafts, and diggings, composing this mine, did not exceed *half a million of pounds.* Of this quantity, Messrs. Samuel Perry & Co. were the manufacturers of about 300,000 lbs. They contemplate making an increased quantity during the present year. John Rice Jones, Esq. is also engaged in penetrating the rock in search of ore, with the most flattering prospects; and is determined, as he informs me, to sink through the upper stratum of limestone, and ascertain the character of the succeeding formations. It is highly probable, reasoning from geognostic relations, that the lower formations will prove metalliferous, yielding both lead and copper, and such a discovery would form a new era in the history of those mines. The present mode of promiscuous digging on the surface would then be abandoned, and people made to see and to realize the advantages of the only system of mining which can be permanently, uniformly, and successfully pursued, viz. *by penetrating into the bowels of the earth.*

Several other persons of intelligence and capital are also engaged in mining at this place, and it is probable that the total amount of lead manufactured at this mine during the year 1819, will fall little short of *one million of pounds.*

It is not to be inferred, however, that because the number of miners at Potosi has decreased, the mines are exhausted. On the contrary, there is reason to conclude, as already mentioned, that the principal bodies of ore have not yet been discovered, and that it is destined to become the seat of the most extensive and important mining operations. The ore heretofore raised at these mines has been chiefly found in the stratum of earth which forms the *surface* of that country, and is bottomed on *primitive* limestone. This stratum consists of a stiff red clay passing in some places into marl, and in others partaking more of the silicious character forming a *loam*, and imbedding the ores of lead, accompanied by sulphate of barytes, calcareous spar, blende, pyrites, quartz, fragments of hornstone, chalcedony, flint, and other silicious substances. The depth of this soil is from 10 to 20, and sometimes 30 feet, and in this the diggings have been chiefly done, requiring no other machinery than is used in digging a common well; and the rock has generally put a stop to the progress of the miner, although veins of ore penetrating it have often invited him in the pursuit. But it requires different tools, machinery, and works for mining in rock; the process is also more tedious and expensive, and is considered especially so by those who have been accustomed from their youth to find bodies of ore by a few days digging in the earth, and who, if they should work a fortnight at one place and not fall upon a bed of ore, would go away quite disheartened. The principal search has therefore been made in

the sub-stratum of clay, where large bodies of ore are sometimes found by a day's, and sometimes by an hour's work. Hence in the vicinity of Mine à Burton the ground has been pretty well explored, and more search and labour is required to find it, than in other and more distant places, where new mines continue annually to be discovered. But, with the exception of Austin's shaft, who sunk 80 feet, and the mines opened by Jones, the rock at this mine remains unpenetrated. Austin found large quantities of ore filling crevices in the rock, and the appearances were flattering when the last work was done. In sinking down, a change in the rock was experienced, passing from compact primitive gray limestone, by several gradations, into a loose granulated limestone, very friable, and called *sand stone* by the miners. This stone was in some instances completely disintegrated, forming a calcareous sand, and the most compact bodies of it, on a few weeks exposure at the mouth of the shaft, fell into grains. These grains were however wholly calcareous, and were readily soluble in the nitric and muriatic acids. The sand submitted to experiment was all taken up completely, nor was any sediment deposited by many months standing. On going deeper, the rock again graduated into a compact limestone, very hard, and of a bluish gray colour, in which were frequently found small cavities studded over with minute pyramids of limpid quartz. These variations in the geological structure of the earth in that place. are still observable by the stones, spars, and other minerals lying around the mouths of the

mines, and, upon the whole, the appearances are such as to justify a conclusion that the lower strata of rocks at Potosi and the numerous mines in its vicinity are of a metalliferous character, and such as to warrant the expenditures incident to a search.

From a statement lately drawn up, and certified by the proprietors of warehouses at Herculaneum, it appears that the total quantity of pig and bar lead, and shot, exported from that place, from Jan. 1, 1817 to June 1, 1818, a period of 18 months, was 3,194,249 pounds. Herculaneum may be considered the depot for the lead of Mine Shibboleth, Richwoods, Belle Fontaine, a portion of the lead of Mine à Burton and Potosi, and a few other mines in that neighbourhood. Perhaps nearly, or quite half, of the whole quantity of lead yearly smelted at the Missouri mines, is shipped from this place. Here then is an average product of 2,395,667 lbs. per annum, for the years 1817 and 1818, from those mines which send their lead to Herculaneum. Assuming the ground that these mines produce only half of what is annually made at the whole number of mines, which I conclude may be a true estimate, we shall arrive at the conclusion, that the annual product of the Missouri mines for those years was *four millions, seven hundred and ninety-one thousand, three hundred and thirty-four pounds.* This, estimated at the present price of 4 cents per pound, gives us a sum of *one hundred and ninety-one thousand, six hundred and fifty-three dollars.* This is the produce of one year; and supposing the mines to have produced the same average quantity during every year, since they have been

in possession of the United States, makes a sum of $ 3,066,148, which is one fifth of the original cost of Louisiana, as purchased from France during the administration of President Jefferson. Let those who have any doubts of the value of our mines, reflect upon this, and consider that it is the product of a year, when the mines were in a manifest state of decline, and wrought wholly by individuals, with a foreign competition to oppose, and without the benefits resulting from a systematic organization of the mining interest.

Nearly all the lead smelted at the Missouri mines, is transported in carts and waggons from the interior, to St. Genevieve, and Herculaneum. As it must necessarily be deposited for storage at those places, it was expected authentic accounts of the lead manufactured in the territory for many years, might be obtained on application. But in this, I experienced some degree of disappointment. At St. Genevieve, although a ware-house has been kept at the landing for many years, the lead sent to town has not all been stored there. From the earliest time, and before the establishment of a ware-house by Mr. Janies, the French inhabitants of St. Genevieve had all been more or less engaged in the storage, purchase, and traffic of lead. Every dwelling house thus became a store-house for lead, and in these cases, no regular accounts were kept of the quantities received or delivered. The same practice, has, in some measure continued since, so that it is impossible to obtain, with any precision, the amount shipped from this place. At Herculaneum a ware-

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house has been kept since the year 1816, and on application to Mr. Elias Bates, the proprietor, he was so obliging as to allow me permission to peruse his book of receipts, for the purpose of making extracts. The following details embrace the receipts of lead at that place for a period of two years and eleven months, ending May 18th, 1819.

I. *A series of receipts from June* 16*th*, 1816, *to Dec.* 31*st*, *of the same year, being a period of six months and fourteen days.*

Fol. 1. Aggregate of receipts,	52,781 lbs.
2.	57,097
3.	55,039
4.	58,892
5.	50,639
6.	63,787
7.	55,663
8.	47,287
	441,185
Aggregate of separate individual accounts during the same period,	322,134
	763,319

II. *A series of receipts from* 31*st* *Dec.* 1816, *to* 31*st* *Dec.* 1817.

Fol. 1.	Aggregate of receipts,	12,375 lbs.
2.		51,521
3.		49,024
4.		60,576
5.		54,242
6.		47,321
7.		60,956
8.		51,420
9.		43,774
10.		42,694
11.		47,958
12.		15,482
		537,343
Aggregate of separate individual accounts during the same period,		501,903
		1,039,246

III. *A series of receipts from Dec.* 31*st*, 1817, *to* 31*st* *Dec.* 1818.

Fol. 1.	Aggregate of receipts,	24,261 lbs.
2.		45,981
Amount carried forward,		70,242

Amount brought forward,		70,242 lbs.
Fol. 3. Aggregate of receipts,		31,041
4.		39,424
5.		34,711
6.		44,266
7.		31,315
8.		56,442
9.		33,932
		341,372
Aggregate of separate individual accounts during the same period,		112,203
		453,575

IV. *A series of receipts from Dec.* 31*st*, 1818, *to May* 18*th*, 1819.

Fol. 1. Aggregate of receipts,	14,764 lbs.
2.	44,323
3.	44,628
	103,715
Aggregate of separate individual accounts during the same period,	26,211
	129,926

Recapitulation.

1816..................	763,319 lbs.
1817..................	1,039,246
1818..................	453,575
1819..................	129,926
	2,386,066

During eighteen months, of the same period, viz. from Dec. 31st, 1816, to June 1st, 1818, there was deposited with, and shipped by sundry other persons in Herculaneum, as ascertained by Col. S. Hammond, and M. Austin, Esq. 517,495 pounds of lead, and patent shot, manufactured by Elias Bates and Christian Wilt, to the amount of 668,350 lbs. For the remaining part of the estimated term, (two years and eleven months,) it is reasonable to presume, that a like quantity of lead was exported through private channels at Herculaneum, and a like quantity of shot manufactured by Messrs. Bates and Wilt. This will make the quantity of pig and bar lead shipped by individuals, 1,031,990 pounds, and the quantity of patent shot manufactured, 1,356,700 pounds; which two sums added to the receipts of Mr. Bates' ware-house, as detailed above, gives us an aggregate amount of *four millions, seven hundred and fifty-seven thousand, nine hundred and ninety pounds*, for the period of two years and eleven months. St. Genevieve, as has already been mentioned, is probably the store

house for one half of the mines, and may therefore be estimated to have received and exported the same quantity of pig and bar lead during the same period, making a total sum of *nine millions, five hundred and fifteen thousand, five hundred and twelve pounds*, which gives an average product of rising of three millions of pounds of lead per annum.

It would be interesting to know in what proportion the different mines have contributed to this amount. The above details show us their collective importance, but we should then be enabled to estimate their individual and comparative value. With this view, I have compiled, from the best information, the following

ESTIMATE.

Mines.	*lbs. of lead.*	*no. of hands.*
1. Mine à Burton,	1,500,000	160
27. Mine Shibboleth,	2,700,000	240
43. Mine La Motte,	2,400,000	210
39. Richwoods	1,300,000	140
41. Bryan's Mines, 42. Dogget's Mines,	910,100	80
6. Perry's Diggings,	600,000	60
28. Elliot's Mines, 26. Old Mines, 29. Belle Fountaine,	45,000	20
17. Mine Astraddle, 33. Mine Liberty, 34. Renault's Mines, 36. Mine Silvers, 35. Miller's Mines,	450,000	40
Am't carried forward,	10,905,000	950

Mines.	*lbs. of lead.*	*no. of hands.*
Am't brought forward,	10,905,000	950
30. Cannon's Diggings,		
32. Becquet's Diggings,	75,000	30
10. Little Mines,		
11. Rocky Diggings,		
5. Citadel Diggings,		
25. Lambert's Mine,	1,160,000	130
9. Austin's Mines,		
10. Jones' Mines,		
12. Gravelly Diggings,		
19. Scott's Mine,		
3. Mine à Martin,	50,000	20
2. Mine à Robino,		
	11,180,000	1130

4. New Diggings,	not worked.
38. Pratt's Mine,	do
40. Mine à Joe,	do
44. Gray's Mine,	do
8. Rosebury's Mine,	do
23. Moreau's Diggings,	do
22. Henry's Mine,	do
7. Hawkins' Mine,	do
15. Bibb's Mine,	do
24. Tapley's Diggings,	do
37. Fourche à Courtois,	do
21. Micheaux's Diggings,	do
18. Masson's Diggings,	do
16. Tebault's Diggings,	do

Mines.

13. Brushy-run Digging, not worked.
14. Stricklin's Diggings, do
19. J. Scott's Diggings, do
45. M'Kane's Mine, do

In this estimate are included all persons concerned in the operations of mining, and who draw their support from it, wood-cutters, teamsters, and blacksmiths, as well as those engaged in digging and smelting lead ore, &c. The estimate is supposed to embrace a period of three years, ending 1st June 1819, and making an average product of 3,726,666 lbs. per annum, which is so near the result arrived at in the preceding details, as to induce a conclusion that it is essentially correct, and that the mines of Missouri, taken collectively, yield this amount of pig lead annually.

The United States acquired possession of the mines, in the year 1803, fifteen years ago last December, and assuming the fact, that they have annually produced this quantity, there has been smelted under the American Government, *fifty-five millions* of pounds of lead.

On the view which has now been taken of the Missouri mines, it may be proper here to remark,—

1. That the ores of these mines are of the richest and purest kind, and that they exist in such bodies, as not only to supply all lead for domestic consumption, but also, if the purposes of trade require it, are capable of supplying large quantities for exportation.

2. That although at different periods, the amount of lead manufactured has been considerable, yet, this produce has been subject to perpetual variation, and, upon the whole, it has fallen in the aggregate, far short of the amount the mines are capable of producing. To make these mines produce the greatest possible quantity of lead of which they are capable, with the least possible expense, is a consideration of the first political consequence, to which end it is desirable,—1. That the reserved mines be disposed of to individuals, 2. Or, that the term for which leases are granted, be extended from three to fifteen years, which will induce capitalists to embark in mining, who are now deterred by the illiberality of governmental terms. 3. That there be laid a governmental duty of two and a half cents per pound on all imported pig and bar lead, which will exclude foreign lead from our markets, and afford a desired relief to the domestic manufacturer. The present duty is one cent per pound. But this does not prevent a foreign competition, and the smelters call for, and appear to be entitled to further protection.

3. That although the processes of mining now pursued, are superior to what they were under the Spanish Government, yet there is a very manifest want of skill, system, and economy in the raising of ores, and the smelting of lead. The furnaces in use, are liable to several objections. They are defective in the *plan*, they are constructed of improper materials, and the workmanship is of the rudest kind. Hence, not near the quantity of metallic lead is extracted from the ore which it is

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capable, without an increase of expense, of yielding. There is a great waste created by smelting ore in the common log furnace, in which a considerable part of the lead is volatilized, forming the *sublimated matter*, which adheres in such bodies to the sides of the log furnaces, and is thrown by as useless. This can be prevented by an improvement in its construction, so as to prevent too fierce an introduction of heat into the ore before it is completely desulphurated; or, the *sublimed lead* thus created, may be reduced into metallic lead, by proper treatment with charcoal, as mentioned in a former part of this work, (see page 79.) No such waste is said to occur in the common English hearth furnace for smelting lead ore, (for a plate and description of which, see the Emporium of Arts and Sciences, new series, by Thomas Cooper, Esq.) To pursue mining with profit, it is necessary to pursue it with economy; and true economy is, to build the best of furnaces, with the best of materials. At present the furnaces are constructed of common limestone, which soon burns into quicklime, and the work requires rebuilding from the foundation. Not only so, the frequency with which they require to be renewed, begets a carelessness in those who build them, and the work is accordingly put up in the most ordinary and unworkmanlike manner. Instead of limestone, the furnaces ought to be constructed of good refractory sand-stone, or apyrous clay, in the form of bricks, which will resist the action of heat for a great length of time. Both these substances are the production of that country, specimens of which are now in my possession.

4. From the information afforded, it has been seen, that the mines are situated in a country which affords a considerable proportion of the richest farming lands, producing corn, rye, wheat, tobacco, hemp, flax, oats, &c. in the greatest abundance, and that no country is better adapted for raising cattle, horses, hogs and sheep. The country is well watered, and with the purest of water, the climate is mild and pleasant, the air dry and serene, and is healthy in an unusual degree. Every facility is also afforded by its streams, for erecting works for the manufacture of white and red lead, massicot, litharge, shot, sheet lead, mineral yellow, and the other manufactures dependent upon lead, as well as wool, flax, and hemp. The country also abounds with various useful minerals beside lead, which are calculated to increase its wealth and importance. It is particularly abundant in iron, zinc, manganese, sulphur, salt, coal, chalk, ochre, and flint.

5. That a systematic organization of the mining interest, would have a tendency to promote the public welfare. To this end there should be appointed an officer for the inspection and superintendence of mines. He should reside in the mine country, and report annually to the proper governmental department on the state of the mines, improvements, &c. His duty should consist in part of the following items, viz.

1. To lease out public mines, and receive and account for rents.
2. To prevent the waste and destruction of wood on the public lands.

3. To see that no mines were wrought without authority.
4. To keep the government informed, periodically, of the quantity of lead made at the different mines, of new discoveries of lead, zinc, iron, or any other minerals whatever, the qualities of such ores or minerals as ascertained by analysis, with the nature of the soil, value of it, &c.
5. To explore the mineralogy of that country, in order fully to develope its mineral character and importance. There should be a particular attention directed towards the beds of copper, silver, tin, and antimony, which are reported to exist in the western country. Connected with these duties, should be the collection of mineralogical specimens for a national cabinet of natural history at Washington.

The superintendent of mines should be a chymist, and a mineralogist, and such a salary attached to the office as to induce a man of respectable talents and scientific acquirements to accept the appointment. To allow the manufacturers of lead every advantage consistent with the public interest; the rent charged on mines, should not exceed two and a half per cent. on the quantity manufactured, which is equivalent to the proposed governmental duty on imported lead, whereby the revenue would not only be kept up, but it might be considerably enhanced. The foregoing details exhibit an annual produce of 3,726,666 pounds of lead, which it is presumable, may be half the quantity the mines are capable of producing, with proper management. But estimating

the lead at four cents per pound, and taking that as the average quantity, the annual rents at two and a half per cent. will create a revenue of thirty-two thousand, four hundred and ninety dollars.

I shall conclude this view with the following section *on the uses of lead.*

SECTION VI.

On the Uses of Lead.

Lead is employed either in a metallic state, or as an oxyd, alloyed with other metals, or combined with various acids, in the following arts and manufactures, viz.—

1st. In the manufacture of White Lead.
2d. .... of Red Lead.
3d. .... of Litharge.
4th. .... of Massicot.
5th. .... of Naples Yellow.
6th. .... of Chromate of Lead.
7th. .... of Patent Mineral Yellow.
8th. .... of Shot and Bullets.
9th. .... of Pewter.
10th. .... of Sheet Lead.
11th. .... of Solders.
12th. .... of Printer's Types.
13th. .... of Pot-metal.
14th. .... of Potter's Glazing.
15th. .... of Enamels.
16th. .... of Flint Glass.
17th. .... of Artificial Gems.
18th. .... of Sugar of Lead.
19th. .... of Metallic Buttons.
20th. .... of Sheet-lead Boxes.
21st. .... of Weights and Measures.
22d. .... of Toys, Castings, &c.

I shall here add a summary account of each of these manufactures, in the order in which they have been enumerated; which is intended to show in one condensed view the utility of this metal in its application to the various economical purposes of life; and it may at the same time serve as a book of reference to such as have not the leisure, or the inclination, to peruse the more voluminous works on the subject.

Man. 1. *White Lead, or Cerusse.* This pigment is prepared by casting the lead into sheets, rolling it up in a spiral form, and setting it to corrode in earthen pots partly filled with vinegar. A gentle heat is brought on by bedding the pots in horse-litter, or by heating the room in which they are set to such a degree as to cause the vinegar to rise up in vapour. This vapour corrodes and unites with the lead, forming a grayish white crusty powder, which is a carbonate of lead. This is afterwards scraped off, ground very fine between two millstones, then washed in water, dried, and sifted. It is afterwards ground *in oil*, and discharged from the millstones into small kegs, of the colour and consistence we usually see it in the shops. There is another way of preparing white lead, by dissolving litharge in the nitric or acetic acids, and adding carbonate of potash or soda, which precipitates the lead united with the carbonic acid of the alkali in the form of white lead. This makes a whiter paint than the other process, but is not thought to stand the weather, or retain its colour so well.

Man. 2. *Red Lead, or Minium.* This is an oxyd of lead, prepared by calcination in a moderate

heat, in a reverberatory furnace for many hours. The furnace employed is built of brick, has a low flat arch like a baker's oven, and admits the air to play freely through it. Melted lead when thus exposed to the joint influence of air and heat, becomes instantly covered with a dusty, ash-like pellicle, which being removed, another is immediately formed, and the process thus continued until the whole is calcined into a yellowish green powder. This powder is then ground in a mill, and washed, when it assumes an uniform deep yellow colour. This, when dry, is again put into the furnace, and heated with frequent stirring, until it turns to a qualified *red*, which, when cold, is taken out and sifted, and is the *red lead* of commerce.

Man. 3. *Litharge.* Nearly all the litharge of commerce is produced from the refining or cupellation of lead, in order to extract the silver from it. The lead is exposed in a shallow broad basin made of clay, bone ashes, &c. called a cupell, to the action of a fierce heat in a blast furnace, which is so contrived that the air forced out of the bellows blows off the oxyd from the surface of lead as soon as formed, and thus the lead is all converted into litharge; but the silver it contains is not oxydable by exposure to heat, and therefore remains in a metallic state at the bottom of the cupell. Litharge is easily reduced into metallic lead again by heating it in contact with charcoal, and much of what is produced at the refineries is thus converted into lead again.

Man. 4. *Massicot.* This is white lead exposed to such a degree of heat in a crucible as is necessary to convert it to the desired colour. This depends wholly upon practice, and the whole skill of the art consists in stopping the heat at a particular stage of the process when the colour is most beautiful.

Man. 5. *Naples Yellow.* To prepare this colour, lett he following receipt be observed. Take 12 oz. of white lead, 2 oz. of antimony, half an ounce of calcined Roman alum, and 1 oz. of sal. ammoniac. Pulverize and mix them well together, put them into a clean earthen crucible with a cover, and expose it to a moderate heat for 3 hours. The result is a yellow vitrified mass, which, when pulverized, is fit for use.

Man. 6. *Chromate of Lead, or Chromic Yellow.* This beautiful pigment is prepared in the United States from a mineral substance called *chromate of iron*, and a solution of lead in the nitric or acetic acids. The processes appear to be somewhat complicated, and from the difficulties frequently met with in the preparation, it is probable a more accurate knowledge of chymical processes is required than generally falls to the share of a mere manufacturer.

Man. 7. *Patent Mineral Yellow.* "Take 66 lbs. of litharge and one bushel of salt. Dissolve the salt in a pan, strain the liquor to detect any impurities, then pour it back into the pan, and add the litharge, at the same instant raising your fire, which is to be kept up for three hours, until the mixture becomes perfectly white. Then wash out

the alkali that remains in the sediment by repeated waters, adding it to the liquor poured off. Take the sediment, which is a muriate of lead, dry it on chalk stones; when dry, put it into a crucible half filled, and melt it in an air furnace."—*Dr. Hunter.*

The crucible should be covered, for any carbonaceous matter falling in would reduce the muriate into metallic lead. It must be left in the furnace till cold, to preserve its crystallized form. This is the valuable, scarce, and high-priced substance used in the painting of carriage bodies, chairs, &c.

Man. 8 *Shot.* A considerable proportion of the lead made in this (Missouri) Territory is manufactured into shot. There are 3 shot towers in the vicinity of Herculaneum, where shot is made by letting it fall down the banks of the Mississippi. The banks at this place consist of limestone, which forms a perpendicular bluff of about 100 feet immediately at the water's edge, both above and below the town. On this bluff a small wooden tower is erected, with a furnace and kettles for preparing, smelting, and casting the lead, and having a projection in front, from which the lead is dropped into a receptacle with water below, where there is another building and apparatus for glazing and polishing. The lead, previous to being dropped, is prepared by mixing with it a small quantity of arsenic, which renders it more fluid in casting, and increases its hardness when cold. It is melted in an iron pot in the upper part of the tower, and poured into a copper seive, made by perforating a copper pan full of holes, of the size of the shot, through which the globules of fluid lead drop into

the cistern below. By the time they reach the water they have become sufficiently cool to preserve their globular shapes. Shot of the largest size require to be dropped from the greatest height, say 140 feet, while the small sizes are only suffered to fall about 90 feet. One man will smelt and cast, after the lead is prepared by alloying it with arsenic, from 4 to 5,000 lbs. per day. To polish these will occupy him 9 days. The polishing is done by putting a quantity of shot into a hollow cylindrical wooden vessel or barrel, which is fixed on a shaft and turned by a crank. The action of the shot against each other, converts them into perfect spheres, and a little plumbago which is added gives them a gloss, in which state they are ready for market.

An improvement has lately been made here by Mr. Elias Bates, which facilitates the casting of shot, and supersedes the necessity of using a seive. He has a ladle of cast iron, in the shape of a parallelogram, but smaller at the bottom than the top. The two longest, being opposite sides of this ladle, are perforated with holes near, and at an equal distance from, the top, so that by canting the ladle a little either way, the shot drop through, and as the ladle is smallest at the bottom, are not at all impeded in their way to the cistern below. The quantity of shot made here for 18 months, ending 1st June, 1817, was 668,350 pounds. The present price of shot is $7.50 per cwt. The business, I am told, has been very profitable.

Man. 9. *Pewter.* This is an alloy of tin, with lead, zinc, or antimony. There are three kinds in

common use, viz. *plate*, *trifle*, and *ley*. The best sort of pewter is said to consist of a mixture of 100 parts of tin to 17 of regulus of antimony. This is the old English composition, but of late years the antimony has given place to lead, which forms an alloy much inferior in colour, hardness, and brilliancy. Our American pewter is nothing more than about equal proportions of lead and tin. The French add a little copper in their pewter. Zinc, when added in any considerable quantity, increases its hardness and lustre, without communicating any dangerous properties, as copper is supposed to do.

Man. 10. *Sheet Lead.* In the manufacture of this article, the lead is poured in a fluid state on a stone or earthen table, around which is a small ledge to keep in the lead, and of the height of the intended thickness of the sheet. The redundant lead is then swept off by a straight-edge, and while it is yet moderately warm, the sheet is passed between iron rollers, which reduces it to an uniform thickness, and gives it a smooth and even surface. Sheet lead is largely employed in ship building, in securing the decks of vessels :—also in covering the roofs of houses, in lining cisterns, bathing tubs, making house gutters, and pipes for conveying water under ground, and for sundry other economical purposes.

Man. 11. *Solders.* There are of various kinds, and are made by melting together different proportions of lead, tin, bismuth, &c. That kind employed by tinmen, under the name of *soft solder*, consists of *two* parts of lead to *one* of tin.

Man. 12. *Printers' Types.* The composition of the common type metal of the letter founders is stated to be 4 parts of lead to 1 of antimony, though some are accustomed to add a little copper or brass. Bismuth is said to improve the composition, for this metal possesses the remarkable property of expanding a little on cooling, so that letters are more full and perfect, and the impression from such type is more delicately accurate, than when lead and antimony alone are employed. Type in which bismuth forms any considerable part are, however, of so fusible a nature as to melt in a candle.

Man. 13. *Pot-metal.* This consists of lead alloyed with copper, in various proportions. About one fifth part of copper in generally employed. The recent invention and introduction into general use, of Britannia and other wares, has now almost superseded the use of *pot-metal.*

Man. 14. *Potter's Glazing.* The common lead ore (galena) is used for glazing coarse pottery, without any other preparation than pounding and mixing with a little argillaceous earth, to enable it to form a better body on the ware. Hence its ancient name of *potter's ore.* Red lead is used for the same purpose, and all our home-made coarse brown pottery is glazed with red lead, or litharge, aud a very vitrifiable clay impregnated with silex and oxyd of iron. Red lead also enters into the composition of some of the finest and richest kinds of glazing. Of this kind was the glazing, or enamel, used upon the once admired *Delf ware.*

Man. 15. *Enamels.* Enamels are either laid upon earthy or metallic substances. They differ little except in the degree of fineness, and nicety with which they are prepared. The fine white opaque enamel, such as is laid upon watch faces, metallic snuff boxes, and other fine works, is composed of silicious sand, oxyd of lead, oxyd of tin, and a minute portion of oxyd of manganese. When it is intended to be coloured, other metallic oxydes in very minute doses are employed, as cobalt for a *blue*, copper for a *green*, &c. These ingredients are prepared with great attention, and melted in an air furnace in luted crucibles. The mass when cold is pulverized and triturated very fine, then mixed with vegetable oil, and laid on with a brush according to the rules of painting, and afterwards exposed in a muffle to such a degree of heat as will just melt the enamel. The management of this part is attended with great difficulty, and upon the whole, it is an art requiring the exercise of great skill, and unwearied patience. The surface of the enamel is afterwards ground and polished in the manner of the lapidary. In this way gold, silver, copper, and other metals are enamelled. The enamel laid upon the finer kinds of earthenware is also a work of delicacy. Having been formerly engaged in experimenting on enamels, at the instance of a friend, a potter, who experienced much difficulty in this branch of his art, I shall here give the result of my experiments, and whoever follows them faithfully will not be disappointed.

A Receipt and Process for making Potters' Enamel.

I. Melt ten pounds of lead with two pounds and a half of block tin, in an open vessel, so that the surface of the metal may be in contact with the atmospheric air. A proper apparatus for this purpose is a shallow cast iron pan or basin, set in brick-work, with a small flue for the fire beneath. As soon as the metal melts, its surface will be covered by a thin pellicle or *scum*, which is the oxyd of tin and lead, and must be skimmed off as fast as it is formed, until the whole is completely oxydated. A bright surface should be always exposed to the air by continual stirring and skimmings, otherwise the calcination will proceed slowly, or if neglected too long, entirely cease, as the oxyd formed on the top will protect the metal from the air, and prevent it from imbibing new portions of oxygen. When the whole is converted into a powder, let all the skimmings be again put into the same vessel, raise the heat so as to bring it to a low red, and continue to stir it for 30 minutes, until every metallic particle has disappeared, and the whole is converted into an uniform gray powder.

II. There is always in an oxyd of this kind, however faithfully it has been calcined, some metallic particles; but so minute, or so completely enveloped by the oxyd, that they are not perceptible to the naked eye. In order to get rid of these let the following process be pursued. Put a quantity of the oxyd into a vessel containing water, and stir it briskly until it is completely suspended therein. Now, as the powder, however

fine, is absolutely insoluble in water, the whole will be again precipitated by suffering it to stand undisturbed a few seconds. The metallic particles will sink first, and the others successively in the inverse degree of their fineness, the most subtile calx always falling last. By seizing the moment, therefore, when the grosser particles have subsided, and pouring off the water with the finer powder suspended in it, the most delicate particles only will be obtained. The remainder must be again put into the calcining vessel, and treated as before. The water used must be pure, and the washing and precipitating vessels should be of glass, so that the operation may be seen.

III. Of the compound oxyd of lead and tin, thus obtained, take 12 pounds; of fine white silicious sand, (such as the glass makers use, and prepared in the same way,) take 10 pounds; and of common salt, dried and pounded, 4 pounds. Mix them intimately together, place the mixture in a clean earthen crucible, and melt it in any heat or situation capable of producing a perfect fusion, and so contrived, that no impurities may fall in during the operation. A small air, or chemical blast furnace will give the desired heat, and a cover luted to the crucible will secure the mixture from any adventitious coloration. Where a glass-house is at hand, that may be resorted to.

IV. While the mixture is still fluid, it may, if wished, be taken out with a pair of crucible tongs, and poured into moulds; or if it is not manufactured for sale, that nicety may be dispensed with, and the fluid mass thrown into a vessel containing

water. This will split it into small fragments, and render it so friable, that it can afterwards be more easily brought to the state of a powder. This must be done by the mortar and pestle, and afterwards by trituration in a wedgewood mortar, the powder then passed through a fine linen sieve, or the grosser particles separated by washing.

V. The fine, dry, impalpable, uniform gray powder thus obtained, is now ready to be applied to the surface of the ware intended to be glazed, and may even be applied to metals, after the manner of the enameller. To apply it to earthen-ware, the usual process of the potter may be pursued, either by mixing it with a solution of the gelatinous and farinaceous parts of grain in water, (as rye-flour,) and dipping the vessel in it, or by dipping the vessel first in the simple solution, and afterwards *sifting on* the powder. Both methods are practised, and either will succeed if well performed. The ware must be previously baked, so that it will greedily imbibe water. It is now to be carried to the furnace, enclosed in a muffle, and submitted to a sufficient degree of heat to melt the glazing. Nothing more is required. The object of the muffle is to prevent fine particles of ashes carried over by the flame, and other accidental impurities, from falling on the ware, which would produce a slight degree of colouration, and impair that delicacy of hue and texture for which this kind of ware is chiefly admired.

By carefully following these directions, a very white, smooth, opaque glazing will be given to any earthen vessel, even such as is made from *a brown*

or dark coloured clay, for the opacity of the glazing is sufficient to hide it. It is desirable that the lead and tin employed in this work should be of the purest kind which is afforded in commerce. Much pains should also be bestowed in selecting and preparing the sand, which must be purely silicious, of a fine even quartzose grain, and possessing that all important property, *easy fusibility*. The washing and sifting should be repeated, and the sieve last made use of, should be of fine bolting cloth, or fine brass wire. The opacity is produced by the oxyd of tin, which possesses, even in small proportion, the property of rendering vitrescent mixtures *white* and *opaque*. The oxyd of lead, and the soda of the common salt, operate as a direct and active flux to the silex of the sand.

Man. 16. *Flint Glass*. This is distinguished from other kinds of glass by its superior purity, density, and lustre; and in the manufacture, a greater attention is bestowed in selecting and preparing the materials, as well as in the composition and smelting. Its composition is, however, chiefly distinguished by the introduction of lead, which is largely employed. It is used in the state of an oxyd, either *litharge* or *red lead*, the latter is preferred, particularly when manufactured from the direct calcination of lead. Litharge is generally contaminated with other metallic bodies, as antimony, bismuth, &c. which not only impair its activity as a flux, but have a direct tendency to communicate a yellow tinge to the glass. The uses of lead in glass are two-fold: as a flux, and as a permanent material of the ware. All the oxydes of

lead operate as a powerful flux to earthy mixtures, particularly those in which silex predominates. Hence, they are introduced into the composition of flint glass, in lieu of potash, which is used only in small quantities in lead glasses. A considerable portion of the potash employed in glass is lost by volatilization, and the quantity is constantly diminishing the longer it is kept in the furnace, and the higher the heat to which it is exposed; so that it is probable if glass were kept long enough in the furnace, it would lose the entire quantity of potash originally put in the composition, at least so much of it as consisted of pure alkali. The oxyd of iron and other metallic and earthy impurities contained in common potash would certainly remain, because they are indestructible by fire, and cannot be volatilized in any heat. The experiments of Loysel on the volatilization of alkali from glass, are certainly conclusive; at the same time, there are few glass-masters who have not become *practically convinced* of the fact; for the longer glass is retained in the fire, after it has been there the usual period of smelting and blowing, the stiffer, harsher, and more unworkable it is. This property of alkaline glasses, which is no inconvenience in the manufacture of *cylinder*, *crown*, or *bottle* glass, where the pots are blown out within 12 hours after melting, is a serious evil to the flint glass maker, who is often employed two days, and when blowing small articles, 4 or 5 days in emptying one pot. It is to remedy this evil, that lead was probably first introduced into the composition, and it certainly has the desired effect, for a pot of

lead glass may be kept a week in the furnace without any sensible diminution of its pliability, or other essential properties. Hence its superior usefulness in this manufacture; it is a flux equally powerful with potash, and without its liability to volatilize. Lead also increases the strength of glass, by enabling it to bear a more sudden transition from heat to cold, and is particularly adapted for cutting and polishing. Its high metallic lustre, weight, limpidity, and powe of refracting light, also sufficiently distinguish it above other species of glass, and particularly adapt it to the manufacture of decanters, wines, tumblers, &c.

Man. 17. *Artificial Gems.* In the manufacture of these, as in glass-making, of which indeed it is only a branch, the different oxyds of lead are much employed. These gems consist of a basis of colourless flint glass, tinged of various hues, by different metallic oxyds, and so as to resemble the emerald, amethyst, opal, carnelian, &c. As an instance, one of the receipts may be given. Mix 16 parts of red lead, 8 of silex, (or rock crystal in powder,) 4 of refined nitre, 2 of borax, and 1 of carbonate of potash. Melt this composition in a close crucible, in a glass-house furnace, or any other furnace capable of giving the required heat. This is a common basis for counterfeit gems, and may be tinged *violet* by manganese, *blue* by cobalt, *red* by gold, *green* by copper, *yellow* by silver or antimony, *white opake* by tin, &c.

Man. 18. *Sugar of lead: Acetite of Lead.* This metallic salt is a combination of lead with the acetous acid, i. e. common vinegar. The process

consists simply in dissolving the corroded lead scraped off sheet lead in the manufacture of white lead, in distilled vinegar. The solution is facilitated by applying a gentle heat, and then set aside to crystalize. If the crystals are imperfect, it is common to re-dissolve, and re-crystalize.

Man. 19. *Metallic Buttons.* These are made of various alloys of copper, zinc, and iron, with lead, tin, silver, antimony, &c. The best are gilt, or silvered, either by plating or washing. No very exact rules can be given for the compositions, for they are nearly as various as the manufacturers themselves, and it is a business in which practice will be found the best instructor. A manufactory of buttons was introduced into the United States, previous to the revolutionary war, by a Mr. Wistar, in the neighbourhood of Philadelphia.

Man. 20. *Sheet lead Boxes.* This manufacture is chiefly concerned in the production of leaden boxes, which are found very convenient for preserving a variety of substances, which would be injured by exposure to air or moisture. Though of no great importance, the manufacture may be presumed to make use of a considerable quantity of pig lead annually.

Man. 21. *Weights and Measures.* These are either made from lead alone, or tin alone, or lead alloyed with tin, or copper, or all three together.

Man. 22. *Toys, Castings,* &c. Under this head a quantity of lead is annually consumed, and therefore forms an item in the catalogue of manufactures dependant upon lead.

Lead is also one of the ingredients used in the composition for silvering glass globes, and in the powder used in polishing glass mirrors, and is also further employed in several preparations in pharmacy, in experimental philosophy, and chymistry, and in a variety of economical uses in the *plumber's art.*

PART II.

OBSERVATIONS

ON THE

GEOGRAPHY, MINERALOGY, GEOLOGY, ANTIQUITIES, SOIL, CLIMATE, POPULATION, AND PRODUCTIONS

OF

MISSOURI,

AND OTHER SECTIONS OF THE WESTERN COUNTRY.

15?

ARTICLE I.

GEOGRAPHICAL OUTLINE OF THE MISSOURI TERRITORY

1. *Situation, Boundaries, and Extent.*

When Louisiana was admitted into the Union as an independent State, all that part of the territory situated north of the 33° of N. latitude, and formerly known as *Upper Louisiana*, was erected into a separate territorial government under the name of Missouri. It also included those boundless plains, and unexplored countries stretching from north to south, at the foot of the Rocky Mountains*, and which pass into the province of Texas on the south, and are bounded on the western line of Louisiana on the east. In the month of March, of the present year, the southern part of Missouri Territory, including the unincorporated regions on the west and south-west, was erected into a separate territory, under the name of Arkansaw, so that the present territory of Missouri consists of all that part of ancient Louisiana, which is neither included in the state of Louisiana, or the territory of Arkansaw. The regions to the northwest, may be considered as an unincorporated wilderness, where the authority of the United States, so far as the

* Called *Chippewan* Mountains by McKenzie, who is followed by Darby in his geographical lectures now delivering in New-York.

Indian title has been extinguished, is maintained in detached posts and garrisons, under the immediate government of military commandants. The bounds of Missouri, as designated in the late law respecting that country, are as follows: beginning on the Mississippi river in latitude 36° north, and running due west on the latitude line to the River St. Francis, thence up that river to 36° 30″ north latitude, thence west to a point due south of the mouth of the River Kanzas, thence north to a point opposite the mouth of the River Desmoines, thence east to the Mississippi river, and down the middle of that river to the place of beginning.

It occupies, therefore, that section of country situated in the great bend described by the Missouri and the Mississippi, from about four hundred miles below the *Grand Turn* of the former, to a point near the junction of the River St. Francis with the latter, including also the point of land formed by the junction of the Missouri with the Mississippi. It embraces some of the most prominent geographical features of the western country, and from the meeting of such mighty streams on its confines, and its relation to all the country situated north and west of it, must become the key to all the commerce of those regions, and is destined to have a commanding influence on the surrounding states, and the political character and mutations of that country. It is bounded by the states of Illinois and Kentucky, from which it is separated by the Mississippi river on the east and northeast, by the territory of Arkansaw on the

south, and by the independent Indian Nations on the west and northwest.

2. *Soil, Climate, and Productions.*

The country west of the Mississippi, differs in some respects, from any other section of the western country, and affords a variety in its physical aspect, which is no where else to be met with. A great proportion of the lands in this territory are of the richest kind, producing corn, wheat, rye, oats, flax, hemp, and tobacco, in great abundance, and in great perfection. The lands bordering on the Missouri as far as the territory extends, are rich beyond comparison. They consist of a stratum of black alluvial soil, of unknown depth and partaking largely of the properties of marl; and the heavy growth of forest trees by which it is covered, indicates the strength of the soil. As you recede from the banks of the rivers, the land rises, passing sometimes by almost imperceptible gradations, and sometimes very abruptly into elevated barrens, flinty ridges, and rocky cliffs. A portion of the territory is, therefore, unfit for cultivation, but still serves as the matrix of numerous ores, which are distributed abundantly in the hills and mountains of the interior. There is very little land of an intermediate quality. It is either very rich, or very poor; it is either bottom land, or cliff, prairie or barren; and we look in vain for those well known characters in the colour, texture, and composition of the soil, which are found in the farming lands of intermediate quality in New-England, New-York, or Pennsylvania. It is a deep black marl, or a high bluff rock, and the transition is often

so sudden, as to produce scenes of the most picturesque beauty. Hence the traveller in the interior, is often surprised to behold at one view, cliffs and prairies, bottoms and barrens, naked hills, heavy forests, rocks, streams, and plains, all succeeding each other with rapidity, and mingled with the most pleasing harmony. I have contemplated such scenes while standing on some lofty bluff in the wilderness of Missouri, with emotions of unmixed delight, while the deer, the elk, and the buffalo, were grazing quietly on the plains below, and if any thing in the natural physiology of the earth, has a power to turn our thoughts from the pursuit of earthly glory, to the contemplation of celestial bliss, to the origin, the nature, and the end of our being, to the connexion between God and man, it must be a scene like this, where we are presented with an assemblage of all that is novel, beautiful, or sublime in the face of nature, far removed from the tumult, dangers, and deceptions of life, and encompassed on all sides by silence, tranquillity and peace.

Situated between the 36th and 40th degrees of north latitude, the territory of Missouri enjoys a climate of remarkable serenity, and temperate warmth. It is equally exempted from the hot summers of the south, and the cold winters of the north, a medium happily calculated to favour the pursuits of agriculture, commerce, and navigation. That clear blue sky so much admired by the aborigines, is characteristic of the country, and an atmosphere of unusual dryness, exempts the inhabitants from those pulmonary complaints which are more or

less the consequence of an atmosphere surcharged with watery particles. The Rocky Mountains serve to shelter this country from those cold north-west winds, which prevail during the fall and winter in some degree, throughout the United States. and which sweeping over the great northern lakes, visit Ohio, Pennsylvania, New-York, and New-England with extreme cold, attended by early frosts in the fall, and late frosts in the spring. Neither are long continued storms common, nothing being more remarkable than the frequent changes of the wind, which seems to be rather an eddy, or counteraction in the current of the atmosphere, caused by the constant and powerful breezes which play around the northern extremity of the Rocky Mountains, than a fixed, and regular current produced by inequalities in the temperature of the air. Rain is common in the summer season, and the earth is thus supplied with a moisture, which it would lack, were it dependant alone upon natural dews.

A country thus situated, cannot fail to prove genial to the vegetable kingdom. It would be difficult to point out a section of country which affords a more interesting field for the botanist. Its prairies and barrens are covered with a profusion of wild flowers, shrubs, and plants, and its cultivated fields yield to the hands of the planter, a great proportion of the useful vegetables of the earth. Corn succeeds remarkably; no country surpasses the banks of the Missouri for the vigour of its crops. Wheat, rye, oats, flax, and hemp, are also raised with advantage. Tobacco is an article

recently introduced, but is found to succeed well, and the lands are said to be as well adapted to its growth as those of Kentucky and Virginia. Cotton is raised in the southern part of the territory *for family use*, but is not an advantageous crop for market. The climate and soil are also adapted to the growth of the sweet or Carolina potatoe, and to fruit trees of various kinds. The peach and the apple are most generally cultivated. Of wild fruits, the woods afford abundance, among which, the grape, percimmon, papaw, pecan, and filbert, are conspicuous. Some varieties of the grape are delicious, and they are very common at the mines, where the inhabitants prepare a wine from them, which has a pleasant flavour, and is a cooling drink in summer*.

3. *Political Divisions, Population, and Principal Towns.*

Missouri is divided into sixteen counties, named and situated as follows:

St. Louis, Franklin, Cooper, Howard, St. Charles, Montgomery, Pike, Lincoln,	Bounded on the Missouri and the Mississippi, and occupying the north and west sections of the territory.

* Missouri Wine. The following is the process for making this wine. Boil 20 lbs. of brown sugar, and clear it, add 12 gallons of water, and the whites of 4 eggs well beaten, then skim it, and set it off the fire to cool, when blood warm, put in the juice of 1 bushel of grapes, when near cold stir it, and put in half a pint of lemon juice, and 6 spoonsfull of yest, and beat it well about in the liquor; stir it every day, put 6 lbs. of good raisins in a clean cask, and throw upon them the above liquor, then bung up the cask, and in 6 months it will be fit for use, or to bottle up.

Lawrence, New-Madrid, Cape Girardeau, Wayne,	Occupying the southern district, and bounded by the Arkansaw territory on the south, and by the Mississippi, on the east.
St. Genevieve, Madison, Jefferson, Washington,	Forming the district of the mines, and occupying the centre of the territory, bounded by the Mississippi on the east, and by the regions stretching towards the rocky Mountains on the west.

Its population, exclusive of the aborigines, has been stated at 46,000, the greatest proportion of whom have emigrated into the territory within the last five years. They consist of people from various parts of the United States, and from Europe. A large proportion are from Tennessee, Kentucky, New-York, and New-England. The original inhabitants were French and Spanish. There are few of the latter remaining, but the former constitute a respectable proportion of the population.

The principal towns of Missouri, are St. Louis, St. Genevieve, St. Charles, and Franklin. Of a lesser size, are Herculaneum, Potosi, St. Michael, New-Madrid, Cape Girardeau, Jackson, Chariton, Florrissant, and Carondelet. St. Louis is the capital of the territory, and by far the largest town west of the Mississippi, or west of Cincinnati, in Ohio. It consists of about 550 houses, and 5,000 inhabitants, and has two Banks, three houses for

public worship, a post office, theatre, land office, and museum, including forty stores, with several mills, manufactories, &c. It is eligibly situated on the west banks of the Mississippi river, eighteen miles below the junction of the Missouri, and from its commanding situation, is destined to become the emporium of the western country.

Franklin, (at Boon's Lick,) on the Missouri, has 150 houses, is the thoroughfare for emigrants to that quarter, and is surrounded by one of the richest bodies of land west of the Alleghany Mountains, and to which emigration is flowing, with unexampled rapidity.

St. Charles, situated twenty-one miles above St. Louis on the Missouri, is also a handsome town, and flourishing, as well as Chariton, one hundred and eighty miles above, at the mouth of a river of that name.

4. *Rivers and Mountains.*

No country in the world affords such an extent of inland navigation by its sreams, as the basin lying between the Alleghany and Rocky mountains, and whose congregated waters are carried to the ocean by those stupenduous natural canals, the Mississippi, the Missouri, the Ohio, and the Illinois. The Mississippi itself, in whose current all these unite, and are discharged into the Mexican Gulph, washes the eastern boundaries of Missouri Territory, from the mouth of the River Desmoines, to near that of the St. Francis, a distance of more than five hundred miles, and may be navigated three thousand five hundred miles from the ocean. The Missouri, swelled by its great tributa-

ries, the Yellow Stone, Little Missouri, White Stone, Soo, (*Sioux*,) Laplatte, Kanzas, and Osage, passes diagonally nearly through its centre, affording on both sides a wide extended tract of soil transcendently rich, and bearing a luxuriant growth of forest trees, and plants, interspersed with prairie. It is navigable, without interruption from its junction with the Mississippi to its falls, a distance of two thousand five hundred and seventy-seven miles, and which is about three thousand nine hundred miles from the Gulph of Mexico. It may be navigated above the falls a vast distance, and into regions which are only known to the savages.

The Ohio is a thousand miles in length from its head at Pittsburgh, to its junction with the Mississippi, and in its passage, successively washes the shores of Pennsylvania, Virginia, Ohio, Kentucky, Indiana, and Illinois,—shores which are covered with villages, towns, and settlements, and lined with an industrious and hardy population of freemen.

The Illinois is also a stream affording a great length of navigation, and lands of superior quality, and has a natural connexion with the great north-western lakes, by which boats may, at certain seasons, uninterruptedly pass from Lake Superior, and the Lake of the Woods.

These rivers communicating with all parts of the country, by their tributaries, afford the advantages of commercial exchange, trade, and manufactures, to a greater extent, and a richer quality of country, than is any where to be found in Europe, Asia, or Africa.

Of these advantages, the territory of Missouri, occupying so commanding a position in the geography of the country, must always partake largely, and may, from the wealth already concentrated in its capital, St. Louis, enjoy almost exclusively, the trade of the Missouri, and upper Mississippi.

The streams which originate within the lines described by the political boundaries of the Territory, and which either during their whole course, or for a considerable distance, meander through it, are the Osage, the Gasconade, Merrimack, Salt River, St. Francis, and Black River. Of a lesser magnitude are Mine River, Manitow, Chariton, Currents, Fourche à Thomas, Eleven-points, and Spring River; the four latter running southerly into the Arkansaw Territory, and discharging their waters into Black River, which is itself a tributary of White River.

The Osage, originates in a prairie country, near the 96th degree of west longitude, about 100 miles north of the banks of the Arkansaw, and after meandering in an east, and north-east direction for a distance of 900 miles, unites with the Missouri 130 miles above St. Louis. In its course it is swelled by several tributaries, the principal of which is the Little Osage, its great south-eastern fork. This river affords in its whole length large bodies of the choicest prairie land, interspersed with wood land, and occasionally with hills, and is navigable for moderate sized boats 600 miles. Its banks afford exhaustless beds of stone-coal, and some iron and lead is found, and its upper forks reach into the country of the Pawnees—a country

rich in salt. The Osage Indians inhabit its banks, and a part of the lands have been purchased by the United States. It is a very beautiful stream, and situated in a delightful climate; and when its borders are opened for emigration, and its resources properly drawn forth, will support a vast population, and a profitable trade. Of this stream, emigrants, and the people of this Territory generally know less than their interests demand. Its fertile soil, genial climate, and great length, entitle it to the rank of one of the first tributaries of the Missouri.

In estimating the length of western Rivers, there is one circumstance, which is neither properly estimated by an eastern reader, nor does it appear to enter into people's calculations here. *It is their serpentine course*, which is so remarkable, that in running one hundred miles on a geographical line, they will, by their great windings, measure at least double that distance, so that a river stated to be one thousand miles in length by its banks, cannot be calculated to traverse a country of more than five hundred miles in extent, and I believe, a fair average of distances, would show the geographical distance less.

The Gasconade enters the Missouri one hundred miles above St. Louis. Its length is about two hundred miles, and it is navigable about half that distance. It is made up of several streams running from a ridge of high lands, separating the waters which fall on the north into the Missouri, and on the south into the Mississippi. Its banks afford but a small proportion of tillable lands, being

bordered with rocks, and sterile hills. The rocks are, however, cavernous, and afford saltpetre, and the hills are covered by pine timber, which is sawed into boards and plank. In these two articles the commerce of this river will always principally consist. The current is rapid, and affords by its fall many mill seats, so that boats and rafts may descend with ease, but its ascent is attended with great labour. On this stream are already situated several saw mills, where boards and plank are cut for the St. Louis market, and several salt petre caves are worked.

The Merrimack. This river originates in high lands, two hundred and fifty miles southwest of its mouth, and is only separated from the waters of the Gasconade by a dividing ridge of land. It is swelled in its course by a great number of streams, the most noted of which, are Little Merrimack, Bourbuse, Fourche à Courtois, Big River, and Mineral Fork. It forms a junction with the Mississippi, eighteen miles below St. Louis, where it is two hundred yards wide. It is only navigable about fifty miles, unless in high floods in the spring and fall, when most of its tributaries may be ascended with boats. This stream waters the country of the mines, and interlocks, by its tributaries, with the waters of the Gasconade on the west, and the St. Francis on the south. The mines of Missouri are situated on its southern shores, which also afford iron, zinc, manganese, and saltpetre. Much of the land on this stream is poor; near its head, are large forests of pine.

Salt River. This river enters the Mississippi one hundred and three miles above St. Louis, and seventy-three miles above the mouth of the Illinois. The settlements on its banks are rapidly progressing, and the lands are noted for their fertility.

St. Francis. This river originates with Big River, and Fourche à Courtois, in broken lands in the south part of Washington and St. Genevieve counties, and joins the Mississippi five hundred miles below. The most noted bodies of iron ore in the western country lie on its head, in Bellevue. The Mine La Motte lead mines also lie along the banks of one of its tributaries. It affords, in its course, a proportion of excellent land, mixed with some that is rocky, and bordered near its mouth with much that is swampy, low, and overflown. A raft of trees, brush, &c. about two hundred and fifty miles above its mouth, obstructs the navigation, which would otherwise be good to within fourteen miles of St. Michael, the seat of justice for Madison county. Millstones and plumbago, (the *graphite* of mineralogy,) are among the mineral products of this river. The substance used for millstones is a red granite, and bears the test of experiment.

Black River has its origin near the heads of the Gasconade and the Merrimack, and is swelled in its course by the River Currents, Fourche à Thomas, Eleven-points, Spring River, and Strawberry River, and forms a junction with White River, about forty miles below Poke Bayou, where the road to Arkansaw and Red River crosses it. The banks of Black River, and of all its tributaries, afford strips of rich alluvial land of more or less

extent. But the intervening ridges are rocky and sterile.

Although there is much high land in this territory, there is perhaps none which is, strictly speaking, entitled to the appellation of a *mountain.* A ridge of land commencing on the banks of the Merrimack, near the Fourche à Courtois, extends in a southwest direction to the banks of White River, in Arkansaw territory, a distance of about four hundred miles, and occasionally rises into peaks of mountain height. This ridge serves to divide the waters of the Missouri from those of the Mississippi, the streams on one side running south into the latter, and those on the other, running north into the former. The body of red granite found on the head of the St. Francis, lies in mountain masses, and forms, in connexion with the accompanying rocks, some of the most rude and terrific scenery, full of interest in a mineralogical, as well as a geological point of view.

5. *Mines and Minerals.*

In the preceding view of the lead mines of Missouri, I have already anticipated much of what might here be properly introduced, and in the catalogue of minerals, which I propose to incorporate with the following part of this work, I shall present a general account of the minerals of Missouri, and other parts of the western country; but as this geographical outline forms an independent article, and may be perused by many who neither read the *View* or *Catalogue*, it will be proper here to give a synopsis of both.

The lead mines in this territory are situated about forty miles west of the Mississippi, and sixty miles southwest of St. Louis. They occupy a district of country between the waters of the St. Francis and the Merrimack of one hundred miles in length, by about forty in breadth, comprising a considerable part of the counties of Washington, St. Genevieve, Jefferson, and Madison. The first lead ore was discovered by Philip Francis Renault, and M. La Motte, acting under the authority of the *Company of the West*, about the year 1720; since which period, the number of mines has been greatly augmented by new discoveries. The number of mines now worked, is forty-five, *thirty-nine* of which are in Washington county, *three* in St. Genevieve, *one* in Madison, and *two* in Jefferson. The quantity of lead annually smelted from the crude ore, I have estimated at three millions of pounds, and the number of hands to whom it furnishes employment, at eleven hundred. The price of lead at the mines is four dollars per cwt. The price paid to miners for raising the ore, and delivering it ready dressed to the smelters, is two dollars per cwt. payable in pig lead. The ore exclusively worked, is the common sulphuret of lead, or galena, with a broad glittering grain. It is found imbedded in sulphate of barytes, accompanied by calcareous spar, blende, quartz, and pyrites. It melts easily, yielding in the large way from sixty to seventy per cent. of pure metal. By analysis, I procured eighty-two per cent.; the residue being chiefly sulphur, combined with a small proportion of carbonated lime and silex;

and the ore contains *no silver*. The most noted and extensive mines are known under the following names:

Mine à Burton,	Mine La Motte,
Mine Shibboleth,	Mine à Joe,
Lebaum's Mines,	Mine Renault,
Old Mines,	New Diggings,
Bryan's Mines,	Mine Liberty,
Pratt's Mines,	Cannon's Mines,
Mine à Robins,	Mine Silvers,
Mine Astraddle,	Mine à Martin.

Other mines of lead are also situated in different parts of the Territory, but have not been explored. The Osage, Gasconade, Black, Strawberry, and Mine Rivers, all afford traces of lead, and there is reason to conclude that extensive bodies of it may be found.

Iron ore is found in very large bodies in Bellevue, Washington County—on Fourche à Courtois, where it is accompanied by manganese;—on Big River;—on Platten and Joachim Creeks, and on the waters of the St. Francis and Black Rivers. Zinc accompanies the lead ore at several mines in Washington County. Antimony has been found in Bellevue, and arsenic in Cape Girardeau, where there is a very extensive body of chalk, accompanied by flint. Red chalk, ochre, salt, nitre, steatite, gypsum, marl, plumbago, porphyry, jasper, chalcedony, barytes, pumice, and granite, are among the useful minerals, of less importance. Stone coal exists in large bodies at Florrissant, and in various places on the Osage River.

6. *Antiquities and Curiosities.* A number of skeletons were discovered in the fall of 1818, on the plantation of Mr. Long, on the River Merrimack, which indicate a stature unusually small, and are supposed by many to be the remains of an extinct race of human beings, of dwarfish origin, who have inhabited the country at a former period. Others have attempted to account for these appearances by a reference to the ancient customs of the North American savages, who are known to have exposed the bodies of their diseased relatives on scaffolds in the air, until all the fleshy parts were decayed and dissipated, when the bones were carefully collected, and funeral obsequies performed, attended by the most extravagant demonstrations of grief. This explanation obviates the shortness of the graves, but is opposed by the relative length of the leg bones, compared with anatomies of the present day. That all these graves, which are very numerous, were the repositories of deceased children, and young persons, would also be conclusive, did not the teeth found indicate persons arrived at the age of manhood. None of the graves exceed four feet in length.

An antique Indian grave opened on the banks of Big River, about 30 miles east of the Merrimack, produced a skeleton, which was estimated to have a stature of eight feet. It was accompanied by pottery, pipes, and *glass beads.*

Those mounds which extend in so remarkable a manner along the banks of the Ohio and its tributaries, are also to be traced up the Mississippi, and are very numerous on the *American bottom.*

and at St. Louis. Those in the vicinity of St. Louis appear to have been constructed for observation and defence. They are very large, and rise to a great height, overlooking a very extensive tract of the surrounding country.

In descending White River, during the winter of 1819, I procured, at a place called the *Bull Shoals*, specimens of an antique malleable alloy, which appears to consist of lead and silver. They were found on the banks of the river, about 15 feet below the soil, which is alluvial, and accompanied by fragments of antique pottery. Ancient stone axes, made from porphyry, are sometimes found in digging wells, mill-dams, &c. in several parts of the Territory; and the hornstone dart is not uncommon.

Among those objects in the physical appearance of this country, which may be looked upon as natural curiosities, are several caves which yield nitre, and a detached mass of granite 15 or 20 miles in length, by about 5 or 6 in width. This geological phenomenon occurs in the south part of Washington County, including a part of Madison County. It contains, imbedded in it, or lying upon its surface, gneiss, greenstone, porphyry, iron ores, and pyrites, blende, and quartz; and may, by a careful investigation, be found to yield other substances. It is a compact red granite, containing very little mica, and is used for mill stones. It is the only mass of granite known to exist between the primitive ranges of the Alleghany and Rocky Mountains, and is surrounded on all sides, and to

an almost immeasurable extent, with secondary limestone.

On the banks of the Merrimack and the Gasconade are found numerous caves, which yield an earth impregnated largely with nitre, which is procured from it by lixiviation. On the head of Currents River are also found several caves, from which nitre is procured, the principal of which is *Ashley's Cave*, on Cave Creek, about 80 miles S. W. of Potosi. This is one of those stupendous and extensive caverns which cannot be viewed without exciting our wonder and astonishment; which is increased by beholding the entire works for the manufacture of nitre, situated in its interior. The native nitrate of potash is found in beautiful white crystals, investing the fissures of the limestone rock, which forms the walls of this cave; and several others in its vicinity exhibit the same phenomenon.

7. *Employments, Manners, Language, and Religion of the Inhabitants.* Of the number of inhabitants now resident in the Territory, I have estimated eleven hundred to be engaged in mining, but the number has been much greater at a former period, one thousand men having been employed at Mine à Burton alone. The residue of the population are farmers, mechanics, and manufacturers, including professional men. There is also another class of society, which I shall notice under the name of hunters. The farming class is by far the largest; as the fertility of the soil, and the advantages of procuring lands on easy terms, and in a mild climate, afford the strongest and surest pros-

pects of gain to the emigrant. There are probably fewer mechanics than is required by the existing population, and of this number a great proportion may be considered persons who lack industry, or do not excel in their particular trades. The wages of mechanics of all kinds are very high, and a scarcity of this class is generally felt in the Territory, and particularly in the new settlements. A carpenter, or a bricklayer, cannot be hired to work short of $2 per day, but are often known to receive more. Other mechanics are also in demand, and an opportunity is presented, by the rapidly increasing settlements, for good, industrious mechanics, from all parts, who cannot fail to meet with due encouragement and success.

Its manufactures, in addition to its grand staple, Lead, consist in the distillation of whiskey from rye and corn, in the flouring of wheat, the fabrication of coarse cotton goods, and tow cloth in private families, and of patent shot, three manufactories of which are established in Jefferson County. Some white lead has been made at St. Louis, and boards and plank for building, are sawed on the Gasconade, and in other parts of the Territory. A clothier's and fuller's works have been recently established on Big River, and a number of tan yards, where raw hides are manufactured into leather, are distributed in various sections of the country.

Made up of emigrants from all other parts of the United States, and from Europe, the inhabitants of this Territory can hardly be said to have acquired a uniform character. Hospitality to

strangers, enterprise in business, ardour in the pursuit of wealth, an elevated pride of country, and perseverance, under the pressure of many difficulties growing out of the infant state of settlements, are the most conspicuous traits in the character of the inhabitants west of the Mississippi. They are robust, frank, and daring. Taught by the hardships and dangers incident to a frontier settlement, to depend for security and success upon their own individual exertions, they rely little upon extraneous help, and feel that true independence, flowing from a conviction that their own physical exertions are equal to every call, necessity, and emergency of life. Observations drawn from habitual intercourse, and from witnessing their public debates, would also lead us to conclude, that their enjoyments arise more from those active and tumultuous scenes attendant upon war and adventures, which require corporeal exertion, than from the arts of peace, refinement, and intellectual research. Hence their manners, contrasted with the inhabitants east of the Alleghany, may be said to be essentially different, and while in their extremes, we see the former verge towards the bold and the intrepid, the latter has a tendency towards effeminacy.

Duelling is prevalent in Missouri, and while the practice continues to receive the sanction of men occupying the first rank in society, it cannot be expected to fall into disrepute; but must, on the contrary, continue to extend its baneful influence over other classes of community, and to involve in some

measure, those in its consequences, who are principled to oppose it.

Those scenes of riot and atrocity, however, which have been imputed to the inhabitants of the mines, by former travellers, do not now exist; the most beneficial changes having been effected in the state of society, in that country. Emigration has added to the former population an accession of talents and intelligence, which has served to mark the society at the mines, with much of the hospitality, decorum, and refinements of life.

The first inhabitants of this part of ancient Louisiana, were French and Spanish ; the former of whom still constitute a considerable proportion of the population, but of the latter, there are very few remaining. The French language is therefore spoken in many settlements, almost exclusively, and many of the Americans have found it advantageous to acquire a knowledge of that tongue.

The most prevalent religion is Methodism. The French are uniformly members of the Roman Catholic church. They have public churches at St. Louis, St. Charles, St. Genevieve, Carondolet, Florrissant, and other places. The Baptists are also numerous, and the recent emigration has added a considerable number of Presbyterians and Episcopalians, but the latter have not, so far as my observation extends, any houses for public worship.

The hunter population in the territory, presents a state of society of which few have any just conception, and of which, indeed, I confess myself to have been wholly ignorant, previous to my tour through those regions where they are located.

Composed of the unruly and the vicious from all quarters, insulated by a pathless wilderness, without the pale of civil law, or the restraints upon manners and actions imposed by refined society, this population are an extraordinary instance of the retrogression of society. So far as is not necessary for animal existence, they have abandoned the pursuit of agriculture, the foundation of civil society, and embraced the pursuit of hunting, so characteristic of the savage state in all countries.

This society is composed of persons from various sections of the Union, who have either embraced hunting from the love of ease or singularity, or have fled from society to escape the severity of the laws, and to indulge in unrestrained passion. Learning and religion are alike disregarded, and in the existing state of society among the Missouri hunters, we are presented with a contradiction of the theories of philosophers of all ages, *for we here behold the descendants of enlightened Europeans in a savage state*, or at least in a *rapid* state of advance towards it. These hunters are chiefly located on White River, Arkansaw, and Red River. Their numbers may be computed at 1000 or 1500. The late division of territory will throw them nearly all into Arkansaw.

VIII. *Savages.* The principal tribe of Indians in this territory are the Osages, a powerful nation residing on the Osage river. They are remarkable for their tall stature, and their fine proportions. It is very rare to see any of them under six feet. They inhabit a delightful country, and are in amity with the United States. The chiefs are heredi-

tary, and in war they fight on horseback. Their warriors are called *braves*, to which honour no one can arrive, without having previously plundered or stolen from the enemy. Hence plundering and stealing are acts of the greatest merit, and demand rewards proportionate to the adroitness or the extent of the act. They are also in the habit of plundering white hunters, and travellers, but are never known to commit murders on such occasions.

A part of the ancient, and once powerful tribes of Shawanees and Delawares, also inhabit this territory. They are located on the banks of Apple Creek, and Fourche à Courtois.

IX. *Slavery.* Many of the plantations and mines are worked by slaves, and among them are to be found blacksmiths and carpenters, whose services are extremely valuable to their masters. The introduction of slavery into this section of the western country, appears to have taken place at an early day, and it has led to a state of society which is calculated to require their continued assistance.

ARTICLE II.

A CATALOGUE OF THE MINERALS AND FOSSILS

OF THE

WESTERN COUNTRY.

1. *Earthy Substances.*

	Sub.		Sub.
Chalk,	1	Stalactite,	43
Flint,	2	Stalagmite,	44
Hornstone,	3	Puddingstone,	45
Rock Crystal,	4	Opal,	46
Novaculite,	5	Jasper,	47
Common Quartz,	6	Agatized Wood,	48
Citrine,	7	Carnelian,	49
Radiated Quartz,	8	Sulphate of Lime,	57
Red Ferruginous Quartz,	9	Sulphate of Barytes,	15
Granular Quartz,	10	Fluate of Lime,	17
Tabular Quartz,	11	Feldspar,	18
Hoary Quartz,	12	Calcareous Spar,	16
Steatite,	13	Basanite,	60
Mica,	14	Buhrstone,	67
Chalcedony,	24	Onyx Agate,	65
Reddle,	36	Greenstone Porphyry,	61
Yellow Earth,	37	Schorl,	62
Opalized Wood,	38	Ochre,	63
Agaric Mineral,	39	Agate,	64
Plastic White Clay,	40	Shale,	66
Fuller's Earth,	41		

2. *Metallic Substances.*

	Sub.		Sub.
Native Iron, ...	69	Iron Pyrites, ...	19
Sulphuret of Lead,........	27	Granular Sulphuret of Lead,	28
Sulphuret of Zinc,........	30	Earthy Oxyd of Lead	29
Red Oxyd of Iron,........	26	Carbonate of Lead, ...	33
Iron Sand, ...	25	Sulphuret of Antimony,....	31
Brown Hematite, ...	21	Black Oxyd of Manganese,	35
Native Magnet, ...	20	Native copper, ...	32
Argillaceous Oxyd of Iron,	22	Sulphate of Zinc, ...	53
Micaceous Oxyd of Iron, ..	23	Sulphate of Copper, ...	54

3. *Saline Substances.*

	Sub.		Sub.
Nitrate of Potash, ...	52	Sulphate of Magnesia, ...	58
Muriate of Soda, ...	51	Native Alum, ...	34

4. *Inflammable and Miscellaneous Substances.*

	Sub.		Sub.
Sulphur, ...	51	Pumice, ...	59
Stone Coal,..............	56	Madrepore,..............	42
Hydrogen, ...	68	Graphite, ...	55

A CATALOGUE

OF

WESTERN MINERALS.

1. *Chalk.*

This mineral is found in great abundance on the west bank of the Mississippi river, in Cape Girardeau county, Missouri Territory. The traveller on ascending the Mississippi from the mouth of the Ohio, passes through a country of alluvial formation, until he reaches the head of Tyawapety Bottom, a distance of thirty-five miles. Here the first high land presents itself on the west bank of the river, in a moderately elevated ridge, running from S. E. to N. W. and terminating abruptly in the bank of the river, which here runs nearly at right angles with the ridge, and has been worn away by the action of the water. This ridge consists of secondary limestone, overlaying a coarse reddish sandstone, and which at the lowest stages of the water in summer, is seen in huge mis-shapen fragments, at the immediate edge of the water, and at intervals nearly half way across the river, as well as on the Illinois shore. It opposes a difficulty in navigating the river in low water with keel boats, and is known among boatmen as the *Little Chain of Rocks.* At this place several beds of chalk are seen breaking out of the

hill side, a few feet above the water, and the bank of the river is strongly characterized with chalk for a quarter of a mile, in the course of which several pits have been opened, and chalk procured for the purposes of commerce, so that it is probable one continuous bed extends for all that distance. Pervading the chalk, are found thin strata of flint, from one to three inches in thickness, and occasionally nodules of pure black gun flint, enveloped by chalk, are also found. The chalk appears to be of a very fine quality, and considerable quantities are annually taken away by traders, and sold in the interior of Missouri and along the Ohio to carpenters and others, who make no complaints of its quality. Indeed, it appears to me on a comparison, to be fully equal to the foreign chalk. It breaks out in masses which possess the compactness of the hardest chalk, has an earthy fracture, a smooth feel, and rubs off with ease, leaving a smooth white trace on wood or paper. Chalk also occurs two miles below the Grand Tower, on the west bank of the Mississippi river, Cape Girardeau county, but no attempts appear to have been made to open the bed, and I can neither speak of its extent or quality. This is directly opposite the mouth of Great Muddie River, a considerable stream of Illinois.

2. *Flint.*

Imbedded in the chalk of Cape Girardeau, are occasionally found nodules of flint, which are enveloped by a hard crust of calcareous carbonate, arranged in concentric layers. Its colour is grayish black, breaks with a perfectly conchoidal fracture, is translucent on the edges, and readily gives fire with steel. It will probably be found in quantity

when the chalk is properly explored, but is at present sparingly dispersed. Strata of flint from one to three inches in thickness are also found alternately with chalk, but it is not of so pure a quality, and does not scintillate so plentifully as the nodular flint.

Flint is also found near the head of Bear Creek, a stream running into White River nine hundred miles above its junction with the Mississippi, in Arkansaw Territory. It is here found in nodules of considerable size, which break with a conchoidal fracture, are translucent, of a yellowish brown colour, and emit sparks very readily. The hunters in that region make use of no other flints, and they possess the art of chipping them out, which is effected with great ease. I have not viewed this mineral *in situ*—and know not its geognostic relations. Hunters, however, report that it is found near limestone rock, and occurs in sufficient quantity to be worth exploring.

3. *Hornstone.*

This subspecies of quartz, is found imbedded in globular and elliptical masses in secondary limestone, at various places on the west, or Missouri bank of the Mississippi, between Cape Girradeau and St. Louis. It may be particularly noticed at the *Grand Tower* and *Hanging Dog*, and it is strewed in detached fragments over the uplands of Cape Girardeau, St. Genevieve, Madison, Jefferson, Washington, Lawrence, and St. Louis counties. Indeed, so far as obervation goes, it characterizes all the district of country between the west banks of the Mississippi river, and the great prai-

ries and sand deserts at the foot of the Rocky Mountains. Its colour is generally brown, with different shades of yellow, black, blue, or red. It appears nearly allied to flint, into which it is sometimes seen passing. It runs also into varieties of jasper, chalcedony, and common quartz, and the different gradations from well characterized hornstone, until its distinctive characters are lost in other subspecies of quartz, may be distinctly marked. The barbs for Indian arrows, frequently found in this region, appear to have been chiefly made of hornstone. This mineral is also found in irregular rounded masses, imbedded in secondary limestone, at the Great Chain of Rocks, Cape Girardeau county, Missouri, and at Choteau's mills in the vicinity of St. Louis.

4. *Rock Crystal.*

One of the most noted localities of this mineral west of the Mississippi river, is the Hot Springs of Ouachitta, (Washitaw,) in Arkansaw Territory. At this place numerous pieces of quartz have been found, very pure and transparent, and beautifully crystallized in six sided prisms, terminated by six sided pyramids. The crystals are found detached, or adhering to the rock, and from half an inch to three inches in length. These springs which present one of the most remarkable phenomenon in the western country, both on account of the heat of their waters, and the variety of minerals found in their vicinity, are situated on Hot Spring Creek, a branch of Washitaw river, and six miles west of the main road from Cadron to Mount Prairie, on Red River. According to the late divi-

sion, they are in Clark county, Arkansaw Territory.

5. *Novaculite.*

A quarry of this mineral, three miles above the Hot Springs of Washitaw, has often been noticed by travellers for its extent and excellency of its quality. A specimen now before me, is of a grayish white colour, partaking a little of green, translucent in an uncommon degree, with an uneven and moderately glimmering fracture, and susceptible of being scratched by a knife. Oil stones for the purpose of honing knives, razors, and carpenters' tools, are occasionally procured from this place, and considerable quantities have been lately taken to New-Orleans. It gives a fine edge, and is considered equal to the Turkish oil stone. It appears to me, from external character, to contain less alumine, and more silex than the common novaculite, and hence, perhaps, its superiority.

6. *Common Quartz.*

This mineral is found in veins of from one to eight or ten feet wide in the argillaceous rock formation, in the neighbourhood of the Hot Springs of Washitaw. It is also seen in very large masses on the south bank of White River, immediately opposite the mouth of the Great North Fork of White River, or what is called on Robinson's new map, *Pine River.* The character of these rocks will not be recognised on a superficial view, for they have a gray time-worn appearance, and are so much covered by moss, that it was not until I had broken off a fragment with a hammer, that I discovered them to be white quartz. Pebbles of

quartz, either white or variously coloured by iron, are common on the shores of White River, and joined to the purity and transparency of the waters, add greatly to the pleasure of a voyage on that beautiful river. Quartz pebbles are also very abundantly dispersed along the banks of Alleghany River, from Olean to Pittsburgh, a distance of three hundred miles.

7. *Citrine, or Yellow Quartz.*

Water-worn fragments of limpid quartz of a yellow colour, and possessing a high lustre and great hardness, are found on the banks of the Mississippi, at various places between Cape Girardeau and St. Louis. I have many specimens picked up near St. Genevieve, Herculaneum, and St. Louis. The colour varies from a light orange yellow, to a brandy red. They are manifestly brought down by the annual floods of the river, and are probably the production of the Mississippi above its junction with the Missouri, but of their geological situation, nothing is known. Their extreme hardness is one of their most distinguishing properties. I have applied the term *Missouri Topaz* in common conversation.

8. *Radiated Quartz.*

This variety is very common at the lead mines of Missouri, and is particularly abundant in Washington County, where it is known under the popular name of *mineral blossom.* It was supposed by the lead smelters to have a strong affinity for lead, but is not much attended to as a sign in searching for lead at the present time. It occurs in detached pieces on the top of the soil, and at

all depths below, and is sometimes attached to rock. Its form is generally that of a hemisphere, consisting of minute layers of chalcedony, covered by pyramids of quartz, all radiating from a common centre. Sometimes it is mammillary. The specimens are strewed with more or less profusion over every hill in the mine tract, and when found in their pristine state, are extremely brilliant and beautiful.

9. *Red Ferruginous Quartz.*

Detached fragments and rolled masses of a very deep red quartz, resembling some varieties of jasper, are found on several of the tributary streams of Merrimack River, Missouri Territory. They possess a flinty hardness, and a high vitreous lustre, are perfectly opaque, and appear to be quartz coloured by, and combined with iron. Mine à Burton Creek, in Washington County, affords good specimens.

10. *Granular Quartz.*

Few persons have travelled from St. Genevieve to the Lead mines in Missouri, without noticing the remarkable bodies of white sand-stone found eight miles from St. Genevieve, on the road to Potosi. This is granular quartz, of a beautiful appearance, easily crushed between the fingers, and falling into a very fine even-grained, transparent, quartzose sand. It possesses no definable tint of colour, is not acted upon by either the nitric or muriatic acids, and appears to be an aggregation of minute crystals of quartz. It occurs in several caves near the road, whose sides are entirely composed of it, and its snowy hue, and granular structure give it

the appearance of refined sugar. It appears to me to be composed of *silex nearly or quite pure*, and possesses, as I find on a treatment with potash, the property of *easy fusibility*, a very essential requisite in the manufacture of glass. A mixture of one part of potash to two of sand, enters readily into fusion in a smith's forge, producing a well melted glass, of considerable density, purity, and lustre. In glass making, sand is the chief ingredient. It is melted in a high heat with potash, salts, and lime, which act as a flux to the sand, and render the mixture fusible and transparent. But it is not every sand which will answer, though it may be very fine, and apparently possess the property of easy fusibility. Nor is a sand which is proper in the manufacture of *window* glass, adapted for *flint* glass, which requires a sand of greater purity. Hence it becomes an object of the first moment, when the establishment of a glass works has been determined upon, to find a sand, or other silicious ingredient possessing the properties necessary to the easy and ready production of the required article. It is not only necessary that it should be capable of producing glass of the desired purity, but also that it shall produce it in a stipulated time, and at a stipulated expense. For where it not necessary that the manufacture should be carried on to a profit, common quartz, pebbles, flint, and any other stones in which silex predominates, might be converted into glass; for the ultimate result of all ingredients wrought by fire is glass. But sand capable of easy vitrification, and of being advantageously converted into glass, is

by no means a common production. Such a sand, generally speaking, should consist of fine grains of transparent quartz, of a uniform size, neither too fine or too coarse, without any perceptible shade of colour, and susceptible of ready fusion with potash. It should not be contaminated by lime, iron, or any other earthy or metallic substance. When iron exists in combination with sands, the colour inclines to green, which will be intense or light exactly in proportion to the quantum of iron present. The presence of lime may be detected by submitting the sand after washing to the nitric or muriatic acids. If an effervescence takes place, you may conclude lime is one of the constituent ingredients. No sand is fit for glass which will effervesce with any of the acids, the fluoric excepted. In the manufacture of common window glass, technically called *cylinder glass* in the United States, sands are frequently employed which are largely impregnated with iron, which is nowise detrimental where the colour of the ware is not regarded, but on the contrary beneficial, for the iron which exists in the state of an oxyd in combination with the sand operates as a flux to the silex, and promotes a more perfect and speedy vitrification. The common yellow and reddish sands, which occur in almost every town and county in the Union, and are used in the manufacture of bricks and mortar, and cements, are wholly unfit for glass. They are largely charged with alumine, besides iron, lime, and various other impurities, which communicate different hues of green, brown, and black, to the mixture, that

cannot be removed in the ordinary way by the addition of manganese. Such sands are only employed in the coarsest branch of the art, namely, the making of *Black Bottles.*

The choice of proper glass-sands becomes therefore an object of first moment, and their localities deserve to be particularly noticed in the catalogue of useful minerals afforded by the United States. I know of but three localities in the Union, in addition to this, where the silicious ingredient of flint glass is furnished. The first is in Lanesborough, Massachusetts; the second on the banks of Maurice River, New-Jersey; and the third at Perryopolis, on the Youghagany River, twenty-three miles above Pittsburgh, in Pennsylvania.

11. *Tabular Quartz.*

The shores of the Mississippi River afford a silicious mineral of singular character, in the form of small irregular shaped detached plates. Its common colour is grayish white, from which it passes into bluish white, milk white, and pale yellow. It possesses, in some specimens, the hardness and translucency of cacholong and chalcedony, to which it seems nearly allied; while in other specimens it resembles certain varieties of white carnelian. I have numerous specimens, picked up on the west bank of the Mississippi, at Herculaneum. Some of these would lead us to suppose, that their tabular form had been produced by being poured out in a state of fluidity on the earth, small pebbles, &c. whose *impress* remains on the under side.

12. *Hoary Quartz.*

Among the numerous pieces of radiated quartz brought from the Missouri Territory, I find *two*, whose external characters are distinct from any of the varieties of quartz hitherto described. This distinction and difference of character appears chiefly on the exterior of the pyramidal prisms of which the mass is composed, having the appearance of being *frosted.*

13. *Steatite.* (Indian Pipe Stone.)

The Falls of St. Anthony, in the Mississippi River, are remarkable for the bodies of steatite found there, and from which the savages are in the habit of making their pipes. Its colour is an uniform dark red, it is compact, and approaches in hardness to the softer varieties of serpentine; it is, however, easily sawed by a common handsaw, or cut with a knife, when freshly quarried, but assumes considerable hardness by long exposure. It is not hard enough to take a polish. This was called a red serpentine by Carver, who has been followed by Pinkerton in his Geography, and by Breckenridge in his Views of Louisiana, and the error has been countenanced by every succeeding traveller who has spoken of it. It is also found near the head of the River Desmoines of the Mississippi; and the St. Peters, and Pipe Stone Rivers of the Missouri. The vicinity of Fort Mason on the Mississippi also affords steatite, whose colours are various shades of yellow and green intermixed.

14. *Mica.*

This mineral is found at the Hot Springs of Washitaw, Arkansaw Territory. The lamina are small, extremely flexible, of a greenish yellow colour, and admitting very little light through their broader faces.

15. *Sulphate of Barytes.* (Heavy Spar.)

Mine à Burton, Old Mines, Mine Shibboleth, and the numerous other mines in Washington County, Missouri Territory, are characterized by sulphate of barytes. At those mines it forms the matrix of the lead ore, though it is sometimes found unaccompanied by ores of any kind, and the quantity which is found at Potosi alone is sufficient, according to our present ideas of its uses, for the supply of the whole world. It is generally found in compact or tabular masses, very white, heavy, and glistening. Sometimes it is crested, columnar, prismatic, or lamellar; and frequently the surfaces of the crystals are yellow, from an ochery oxyd of iron. All the barytes which I have observed in Missouri are perfectly opaque.

16. *Calcareous Spar.*

This spar is one of the minerals accompanying the lead ore at several of the lead mines in Washington county, Missouri Territory. It is, however, never found in contact with the ore, or serving as a matrix, if we except a little found in this situation at Bryan's Mines, St. Genevieve county. It is generally found in detached masses of irregular shape imbedded in the mineral soil, which is a marly red clay, and it invariably breaks into rhombs whose

angles are more or less acute. Its colours are either white or honey yellow, it is transparent, and some specimens possess the beauty and the double refracting power of the *Iceland Spar.*

17. *Feldspar.*

Crystals of feldspar are found imbedded in greenstone on the banks of the river St. Francis, at a place called *The Narrows*, Madison county, Missouri Territory. The colour of the crystals is a flesh red, graduating into green on the edges.

18. *Fluate of Lime.*

This mineral occurs at a lead mine about three miles back of Cave-in-Rock, on the Ohio River, and about fifteen miles south of Shawneetown, Gallatin county, Illinois. Its colours, which are very beautiful, are various shades of purple, violet, and blue. Some specimens are entirely limpid. It is found accompanied by galena, blende, pyrites, &c. imbedded in a stiff red clay, resting on secondary limestone. In the same neighbourhood coal is found, and the United States Saline, situated on Saline River, is about twelve miles distant. It is a highly interesting section of country, and well worthy the particular attention of the mineralogist and the geologist. Cave-in-Rock, famous in that region for having afforded a retreat to the bandit Mason, and his followers, is alone an object of the highest interest, and the intelligent traveller cannot fail to be highly gratified in viewing this stupendous work of nature. The quantity is considerable; it has, however, only been observed in detached pieces, affecting a cubical form, but no compact vein of it has as yet been discovered.

Little doubt, however, can remain, that a search of the ground in that vicinity would bring to light bodies of it, capable of being wrought into vases, and other ornamental works.

19. *Iron Pyrites.*

Unmagnetical pyrites of iron, of a brass yellow colour, have been found on the Fourche à Courtois, and Mineral Fork, two of the tributary streams of Merrimack River, Missouri Territory. Also on White River, within a hundred miles of its source, where it is attached to rock in cubical crystals, and is reported to exist in quantity. I possess good specimens from each of those places, that from the Mineral Fork is connected with calcareous spar. New Diggings, Mine à Burton, Old Mines, and Reno's Mines, also yield pyrites of iron; sometimes handsomely crystallized in cubes, or lameller masses, and sometimes interspersed with blende, heavy spar, and galena.

20. *Loadstone.* (*Native Magnet.*)

This substance is found on the banks of the Washitaw River, at a place called the *Cove*, fifteen miles below the Hot Springs, in Clark county, Arkansaw Territory. The quantity is represented as very great, and it possesses a strong magnetic power. At the same place, other ores of iron are abundant, also pyrites, quartz, white vitriol, &c.

21. *Brown Hematite.*

This ore of iron occurs along with cellular pyrites, and argillaceous oxyd of iron, five miles north of Strawberry River, on the main road leading through Lawrence county, Arkansaw, (lately Missouri) Territory. Its colour is a dark brown, and

its structure is fibrous and glittering; some of its masses are columnar, stalactitic, radiated-reniform, or tuberose, and a few tabular masses are found, consisting of alternate strata of red and brown hematite.

22. *Common Argillaceous Oxyd of Iron.*

This is the ore which is so abundantly found in the independent coal formation, in the vicinity of Pittsburgh in Pennsylvania, and along the banks of the Alleghany and Monongahela Rivers. It is worked at several furnaces and founderies in Alleghany, Fayette, Washington, and Armstrong counties, and brought down to Pittsburgh by water, to supply the extensive founderies of that place. Brownsville and Connelsville, are particularly celebrated for their iron furnaces. Clay iron stone is also the principal ore wrought at Zanesville on the the Muskingum, (Ohio,) and on Brush Creek, from which the foundery at Cincinnati is supplied.

23. *Micaceous Oxyd of Iron.*

A vein of this ore several feet wide, is found in red granite, on the banks of the River St. Francis, at the *Narrows*, Madison county, Missouri Territory. Its unusual appearance has for several years attracted the attention of the inhabitants, who have considered it an ore containing silver. It is situated four miles south of the extensive lead mines of La Motte, and in the centre of a highly interesting geological and mineralogical section of country. The rocks at that place, are the old red granite, in mountain masses, with some veins of greenstone, greenstone porphyry, and gneiss. This is the only body of granite rock in the inha-

bited part of Missouri Territory, and extends for about twenty miles, with an average breadth of six miles. Its course is from S. E. to N. W.

This granitic range, terminates in very rough and broken highlands, in the south part of Bellevue, Washington county, and serves as the matrix or accompanying rock to some of the most extensive and remarkable bodies of micaceous iron ore, that the globe contains. The most noted body is called the Iron Mountain, where the ore lies in such quantity, as to form a lofty ridge, elevated from five to six hundred feet above the plain, and for half a mile in extent. It is a very brilliant, heavy ore, crystallized in glittering lamina. Some specimens are either mixed with, or accompanied by compact red oxyd of iron and quartz. It melts easily, yielding a very malleable iron, and a foundery for working the ore, is now in contemplation.

24. *Chalcedony.*

The banks of the Mississippi river at Herculaneum afford specimens of this mineral, which I consider to be well characterized. It is also found in abundance on the west side of Establishment Creek, St. Genevieve county, Missouri Territory, where it is seen passing into the *onyx agate.* Its colour is a bluish white, which is sometimes exchanged for milk white, yellowish white, or brownish yellow. It is semi-transparent, and strikes fire with steel. Some pieces exhibit spots, zones, or dendrites.

Chalcedony is also found at the lead mines in Washington county, Missouri, where it serves as the basis for much of the radiated and mammillary quartz so common there. The chalcedony appears

in concentric layers of various colours, principally bluish white, from which the crystals of quartz have shot out. The alternating layers are sometimes yellow, brown, or red.

25. *Iron Sand.*

This ore of iron is afforded by the banks of the Arkansaw River, near where the main road to Red River crosses. It occurs in the aggregated form. Its colour is a dark chocolate brown, nearly black, and the masses present small cavities filled with a very fine orange yellow ochery oxyd of iron.

26. *Red Oxyd of Iron.*

A fine red oxyd of iron, in the powdery state, and mixed with small fragments of quartz, is found in a bank on Flint River, a small stream which enters the Tennessee above the Muscle Shoals. The inhabitants employ it as an ingredient in dying. It is also found near the head of Gasconade River, a tributary of the Missouri, and on a journey into the interior last winter, I brought from thence specimens of a compact red oxyd of iron, of a very high colour. It is also found very hard and compact on Elk River, in Tennessee, and occasionally accompanying the micaceous oxyd of iron of Bellevue.

27. *Galena. Sulphuret of Lead.*

The most important locality of lead ore, which the United States, or the world contains, is furnished by the metalliferous limestone of Missouri Territory, and which breaks out, or has been explored at various places from the banks of the Arkansaw to Prairie Du Chien on the Mississippi, a distance, in a direct line from south to north, of

seven hundred miles. On this vein, are situated the numerous mines in Washington, St. Genevieve, Madison, and Jefferson counties, which form the subject of the preceding Treatise. These mines were first explored by the renowned Mississippi Company, A. D. 1719, and have continued to be worked during the successive changes which it has experienced under the French, Spanish, and Americans, to the present period. The number of mines now wrought, is forty-six, the principal of which, are Mine à Burton, Mine Shibboleth, Mine La Motte, Richwoods, Bryan's Mines, and New Diggings; and the quantity of lead annually smelted, is estimated at three millions of pounds. The ore is the common galena, with a broad glittering grain, and bluish gray colour, and is found accompanied by sulphate of barytes, blende, pyrites, quartz, and calcareous spar. It yields on assay eighty-two per cent. of metallic lead, and the remainder is chiefly sulphur.

Galena is also found at Prairie Du Chien, five hundred miles above St. Louis, on the Mississippi, where *it is worked by the savages.* Also at Austin's Mines, in Weythe county, Virg.—At Millersburgh, and Drennon's Lick, in Kentucky.—At Cave-in-Rock, accompanied by fluor spar, in Illinois.—On the Osage, Strawberry, St. Francis, and Gasconade rivers, in Missouri.—And on White River, and the Arkansaw River, in Arkansaw Territory.

28. *Granular Sulphuret of Lead.*

This variety of galena occurs in thin strata in clay, at Mine La Motte, Madison county, Missouri Territory. It has a lead gray colour, which gra-

duates into black, has a granular structure, some of the grains being splendent, but is generally dull and earthy, from mixture with oxyd of iron, and green carbonat of copper. It is worked as an ore of lead, along with the common galena, which is the most abundant ore at those mines.

29. *Earthy Oxyd of Lead.*

At the lead mines at Austinville, in Weythe county, Virginia, a yellow earthy oxyd of lead has recently been found among the rubbish of former diggings, which is found to yield a sufficient quantity of metal to render the smelting a work of profit. From its earthy appearance, it had been thrown out of the mines among clay and gravel, without attracting notice. Its general colour is a brownish yellow, from which it passes to a clay-red greenish yellow, or ash-gray. Some of the most compact specimens appear to have a crystalline structure. Its appearance is generally that of an oxyd, or earth deposited in strata from suspension in water.

30. *Blende, Sulphuret of Zinc.*

Accompanying the lead ores of several mines in Washington county, Missouri Territory, is found a sulphuret of zinc, which is the *black jack* or *mock lead* of miners. As instances, Mine Reno, and Old Mines, may be mentioned. It is not worked as an ore, but when met with in digging for lead, is thrown by as useless.

31. *Sulphuret of Antimony.*

A piece of antimonial ore was picked up several years ago in Bellevue, Washington county, Missouri, but no body has yet been brought to light. About thirty miles north of Edwardsville,

in Illinois, a body of antimony was discovered by a volunteer militiaman during the late war, and specimens of it were distributed to several gentlemen in the neighbourhood of St. Louis.

32. *Copper.* (*Native.*)

A mass of native copper weighing seven pounds, and another weighing three pounds, have been discovered on the highlands back of Harrisonville, the seat of justice for Monroe county, Illinois. Some attempts have also been made to make a discovery of copper ore at that place, and a shaft was sunk about forty feet deep, in the summer of of 1817; but rainy weather commencing in the fall of that year, the shaft was abandoned, and has not since been occupied. In digging that depth, a red compact oxyd of iron and copper was found, and there is reason to conclude, that ores of copper will be found in that neighbourhood. Native copper has also been found on Big Muddie River, in Illinois.

Of the bodies of native copper which exist on the head of the Mississippi, and along the shores of Lake Superior, I can add nothing, in this place, respecting locality, riches or extent, which has not already been published. I did not extend my tour into those regions, and do not think I should add any thing to the stock of useful information, by communicating several reports which I have from hunters and traders on that subject.

33. *Carbonate of Lead.*

I possess several specimens of carbonat of Lead, from Mine à Burton, in Missouri, and Cave-in-Rock, Illinois. At the latter place it occurs as a

crust upon galena, and is also most frequently met with in that form at Mine à Burton.

34. *Alum.*

There is a cave in Bellevue, Washington County, Missouri Territory, which yields alum. It is found effloresced.

35. *Manganese.*

On travelling into the interior, six days' journey S. W. of Potosi, I found a large body of black oxyd of manganese, situated near the head of Merrimack River, Missouri Territory. It is accompanied by ores of iron.

This ore of manganese is also found on the dividing ridge of land between Spring River and the River Eleven-points, in Lawrence County, Arkansaw Territory. It is also accompanied by ores of iron, is very black, and soils the fingers like soot. Another body of manganese occurs on Big Sandy River, near Greenupsburgh, in Kentucky.

36. *Reddle.* (Red Chalk.)

This mineral occurs in a bed of considerable extent in Washington County, Missouri. It is soft enough to take a polish from the nail; of a dark red colour, and leaves a smooth red trace on wood or paper.

37. *Yellow Earth.*

A mineral substance which would readily be mistaken for yellow ochre (*ochery oxyd of iron*) is frequently met with in digging for lead ore at the Missouri Lead mines. It appears, however, to contain too much clay to be considered as an ore of iron, though it is of a beautiful yellow colour, and would probably prove useful as a pigment.

A similar substance is also found near the Chalk banks on the west side of the Mississippi River, in Cape Girardeau County, where a kind of red ochre is also found.

38. *Opalized Wood.*

The banks of the Missouri and of the Mississippi afford a mineral substance, which appears to have originated from the penetration of silicious matter into wood, by which process the vegetable character has been entirely exchanged for the mineral. A ligneous origin is however observable. It is very hard, semi-transparent, and possesses the colour of the opal. It is accompanied by the common agatized wood of the Missouri, by yellow quartz, and by chalcedony. The pieces are commonly small, and in the form of a parallelogram. They are distributed very plentifully along the shores of the Mississippi, between St. Genevieve and St. Louis, Missouri Territory.

39. *Agaric Mineral.*

A soft spongy substance, of a gray colour, and soiling the fingers, which appears to be a pure carbonate of lime, is found as a sediment in a spring, in St. Clair County, Illinois.

40. *Plastic White Clay.*

In digging several pits in search of lead ore at Gray's Mine, Jefferson County, Missouri, a body of white clay was struck at the depth of from 8 to 10 feet, and no ore was found at those places, but the pits and diggings in that place were abandoned in consequence of the clay which covered a considerable area of ground on the banks of Big River, which is one of the principal tributaries of

the Merrimack. This clay is snow white, has a smooth soapy feel, takes a polish from the nail, adheres strongly to the tongue, becomes plastic by mixture with water, retains its hue in the fire, and is infusible in a very high heat. I have employed it in crucibles, in assays, where an intense heat was given, with discovering any other signs of fusion but such as are common to the best Hessian crucibles; and it is probable it may prove valuable in the manufacture of pottery, and particularly of glass-house pots, which require a clay of the utmost purity and infusibility.

Another bed of plastic white clay, which appears to be adapted for the manufacture of glass-house pottery, is found on the Muskingum River, at Zanesville, Ohio. It is white, partaking a little of blue. It has a smooth, soponaceous feel, appears free from sand or grit, adheres strongly to the tongue, and exhibits some other characters which distinguish good, infusible clay. A specimen of this mineral in my possession bears a strong resemblance to the clay of the Rhine, which is brought over from Germany for the same purpose. Yet the Zanesville clay has not been successfully introduced into our western glass-houses, although those concerned in the manufacture feel sensibly the want of a bed of refractory clay west of the Alleghany mountains, as they are compelled to pay very large sums every year for the transportation of clay from Philadelphia. They complain that the pots split open in the fire, but add, that it endures the most intense heat without fusion. I am inclined to believe their want of complete suc-

cess is less attributable to the qualities of the clay, than to the skill which has been exercised in making use of it. In the manufacture of pots, a portion of the clay is always burnt in a high heat, then ground in a mill to a powder, and mixed with a quantity of the crude clay in the state of powder, with water. This burning deprives the clay of its *principle of plasticity*, i. e. converts it into a sort of clay stone, which, when ground to powder, has the same effect as adding refractory sand, namely, preventing its shrinkage and liability to crack, and has this additional advantage, that it does not render the composition fusible, as sands do. When a pot splits open in the furnace, it is an evidence that the mixture is too rich. It has not enough burnt clay. No clay can be too *pure*, or too *refractory*, but in the technical phrase of the glass-house, it can be *too rich*. The precise proportion of burnt to unburnt clay, in using individual qualities, is a matter of considerable importance, and no invariable rule can be given to suit all clays, for whenever a new clay is introduced, preliminary trials on different mixtures of it will be found necessary. Generally, however, such a quantity of crude clay should be taken as will communicate to the whole mass enough of the plastic principle to make it stick well together, and knead into a compact mass. Nothing more is required; and any redundancy in the crude clay renders the pot liable to shrink and crack when it comes to be exposed to the intense heat of the furnace. A thorough acquaintance with the nature of the clays employed, is therefore necessary; and there is no branch

of the manufacture in which more skill is required, or in which artists are oftener deceived. It is from these circumstances, and knowing how soon artists are discouraged by the failure of an experiment on a new substance, that I am disposed to believe the Zanesville clay has not had a fair trial. I may, however, be deceived; since the external character of a clay or other mineral body, though a general, is not an infallible rule to judge by; and there is no result more conclusive than that of a manufactory in the large way, provided the experiment has been skilfully conducted, and all the circumstances accurately minuted.

41. *Fullers' Earth.*

The essential ingredients of this earth are silex and alumine; and its excellency for the purpose of fulling cloth appears to consist in the fineness of the particles of which it is composed, and the intimacy with which they are combined. The banks of the Mississippi are chiefly silex and alumine combined with variable proportions of vegetable matter, and afford all gradations from very coarse to very fine. The finer kinds, and such as are not contaminated with vegetable mould, are a kind of fullers' earth, and it appears in some places exceedingly fine and well characterized. On ascending the Mississippi from the mouth of Ohio to St. Louis, it may be particularly observed in low water, as one of the under strata of Tyawapatie and Bois Brula Bottoms. The great field of St. Genevieve, where it forms the bank of the river, contains some very fine strata of fullers' earth.

which are only observable in a low stage of the water.

42. *Madrepore.*

This animal petrifaction is found near Cave-in-Rock, Gallatin County, Illinois, in a rounded mass, consisting of columnar hexagonal prisms diverging from a centre. Its colour is a brownish yellow, and the columns, which are inverted pyramids, appear to have been hollow at some former period, and are now filled with a hard white silicious matter.

43. *Stalactite.*

Stalactites are found abundantly in several caves on *Cave Creek*, one of the head waters of Currents River, in Missouri Territory. These caves are at present situated in the wilderness, about 80 miles S. W. of Potosi, in the vicinity of Ashley's Saltpetre Cave. The Stalactitæ are found in concretions resembling icicles hanging from the roof, or in columns reaching to the floor, and present a variety of imitative forms. Some specimens are translucent, and the cause which has produced them is removed, the dropping has ceased, and the caves are generally dry, affording now an earth richly impregnated with saltpetre, and this salt is also found effloresced on the rocks, very white and fine. Stalactites are also found in a very large cave on Findley's Fork, one of the tributaries of White River, Arkansaw Territory. They are in enormous columns, and the floor of the cave is covered by stalagmites, from the size of a pea to many tons weight.

44. *Stalagmite.* (Calcareous Alabaster.)

The cave which has just been mentioned on Findley's Fork, affords stalagmite sufficiently

large, compact, and beautiful, for the sculptor's chisel, and would undoubtedly afford some fine specimens of alabaster.

45. *Puddingstone.*

This mineral is dispersed along the shores of the Alleghany River, between the mouth of French Creek and Pittsburgh. It is generally a conglomeration of coarse grains of quartz, or silicious pebbles, cemented by silex or ferruginous clay. That river may also afford specimens which run into a kind of breccia, though I possess no well characterized specimens. And there is also evidence of the existence of sienite. Pebbles of white quartz are very common all along this river. The west bank of the Ohio at Fort Massac in Illinois, and at "America," 10 miles above its mouth, afford Puddingstone consisting of quartzy pebbles cemented by iron. Also, the Chalk banks at Cape Girardeau on the Mississippi.

46. *Opal.*

I possess a single specimen of precious opal, which was procured near Cave-in-Rock, Gallatin County, Illinois. Its colour is milk white shaded with blue; it is incapable of being scratched by steel or acted on by acids, is semi-transparent in a high degree, and *opalesces* on holding it up to the light. The colour it most constantly displays is a reddish yellow. The place in which it was found is remarkable for producing fluor-spar, galena, blende, pyrites, coal, salt, madrepore, calcareous spar, &c. It belongs to the great secondary limestone formation of the valley of the Ohio, and the rocks are cavernous, one of the most remarkable

of which appears in a high bluff of limestone rock on the bank of the river, and generally known as the Cave-in-Rock. Sometimes small caverns in this vicinity on being broken into, yield large quantities of galena unaccompanied by a matrix, but lying loose among dusty particles in the bottom of the cave, and their appearance would lead us to suppose that the matrix had decayed and dissipated, leaving the ore behind.

47. *Jasper.* (Common and Striped.)

Several specimens of this mineral, now before me, were picked up along the banks of the Mississippi, between St. Genevieve and St. Louis.—There is a variety in their colour. The first is a uniform bottle green, very hard, and susceptible of a high polish. The second is the fragment of a nodular mass, consisting of alternate concentric stripes of green, brown, and yellow, the colours passing by imperceptible shades into each other. A specimen found in Potosi consists of alternate stripes of rose and flesh red. Of their original situation nothing is known, as they appear to be rolled fragments out of place, but may be presumed to be the product of some of the tributary streams of the Mississippi.

I had, however, the satisfaction to find this mineral in its proper situation during a journey into the interior of Missouri. It is found as a stratum in secondary limestone, in the bed of Cave Creek, near the head of Currents River, in Missouri Territory, and about 80 miles S. W. of Potosi. Its colours are blue and white striped.

48. *Agatized Wood,*

Is found dispersed along the shores of the Mississippi and Missouri very plentifully, and good specimens may be obtained near Herculaneum and St. Louis.

49. *Carnelian.*

Accompanying the jasper, yellow, and tabular quartz, agatized wood, &c. found on the shores of the Mississippi, some small masses of a very beautiful carnelian are occasionally met with. They are very transparent, hard and brilliant, and of various shades of red and yellow, sometimes arranged in concentric zones, alternating with white; some specimens are dendritic. These last would be considered as agates, were they not possessed of a glassy transparency.

50. *Sulphur.*

A spring exists in Jefferson county, Missouri, the waters of which are highly charged with sulphur, which it deposites on the stones over which it runs. Salt springs are found within a few miles of it, but no gypsum has as yet been brought to light. An idea of its beneficial effects in bilious complaints is generally prevalent, and the springs form a resort for the surrounding inhabitants, who drink copiously of the water.

51. *Muriate of Soda.* (Common Salt.)

The principal works for the manufacture of salt in the western country, are seated on the Seweetly and Scioto Rivers, in Ohio; on the Great Kanhaway, in Virginia; on Saline River in Illinois; at St. Genevieve, and Boon's Lick, in Missouri; and on the Arkansaw and Washitaw Rivers, in Arkan-

saw. About 150,000 bushels per annum, is made at the United States Saline in Illinois, which is sold at seventy cents per bushel at the works. There are two salt springs in Jefferson county, Missouri, where salt is manufactured, but the works are small. The springs on the Arkansaw, are reported to exceed any hitherto discovered, for their extent and the strength of the water. The existence of native rock salt in this region, is still a matter of doubt, but it appears probable that it does exist. In travelling among the hunters and Indians in the interior of Missouri, I made frequent inquiries respecting the rock salt reported to exist near the banks of the Arkansaw, and was told by several that such salt did exist in what they term the *Pawnee Mountains;* that they had seen and used of it, that it was white and clear like alum, and the white hunters added, that the Pawnee and Osage Indians, were in the habit of procuring their salt from that spot.

52. *Nitrate of Potash.* (Salt Petre.)

Three saltpetre caves are worked in Washington county, Missouri Territory. They are situated on the Merrimack. Several caves are also worked on the Gasconade River, and a very extensive one, which I visited last winter, on the head of Currents River, on a stream, which from the numerous caves upon it, I have called *Cave Creek.* In travelling in that region, it is common to find crystallized nitre filling the small crevices of limestone rock, and there are few caves which do not afford traces of this salt.

53. *Sulphate of Zinc.* (White Vitriol.)

On the authority of Dr. Andrews, of Mount Prairie, on Red River, I mention the existence of native sulphate of zinc, on Washitaw River, in Clark county, Arkansaw Territory. It is found in a highly interesting section of country, about fifteen miles below the Hot Springs, and which also affords iron, loadstone, novaculite, quartz, mica, &c. The rock formation is argillaceous slate, traversed by veins of white quartz.

54. *Sulphate of Copper.* (Blue Vitriol.)

On the authority quoted in the preceding article, I also mention the existence of native sulphate of copper at the same place, and a saline substance, which answers the purpose of Glauber's salts.

55. *Graphite.* (Plumbago.)

The vicinity of Mine La Motte, Madison county, Missouri Territory, affords specimens of graphite. It is also found on Big River, in the county of St. Genevieve, quantity small. Since my return from Missouri, I am informed by letter, that a very large body of plumbago has been discovered twelve miles south of Potosi in Washington county.

56. *Coal.*

Coal is abundant at Pittsburgh, in Pennsylvania. It is found directly opposite the city, on Coal Hill, from which the founderies, and glass-works are supplied.—On the Alleghany River, at various places as high up as Kittanning, and along the Monongahela, nearly to its source. It is a coarse coal, very black and shining, sometimes beautifully irised, with a slaty uneven fracture, a moderate weight and hardness, and perfectly bi-

tuminous. It inflames easily, burns with a pitchy smoke, and bituminous smell, and throws out a great heat. It occurs in veins in secondary limestone, along with argillaceous slate, indurated clay, red sandstone, and bituminous shale, which are arranged in alternate strata, one above the other, and preserving an exact parrallelism with the waters of the Alleghany, Monongahela, and Ohio Rivers. The coal always constitutes a vein between the shale and clay which are found immediately above and below it. The clay appears to have originated from the decomposition of shale, for it may be observed in all stages of the decomposition from a well characterized argillaceous slate to plastic clay.

The veins of coal are from a foot to nine feet in thickness, and the strata of coal, shale, limestone, &c. are *repeated*, so that the sides of the hills which afford coal, exhibit several strata, with the rock intervening, one above another. The greatest distance in a perpendicular direction from one stratum to another, is perhaps one hundred feet, and such is the regularity of the coal formation in this region, that the description of one pit or bed, will apply almost equally to any other, within a circuit of two hundred miles, every section of which is more or less characterized by coal. It generally breaks out on side hills, as on the *coal hills* at Pittsburgh; and those hills are elevated many hundred feet above the waters, so that they are easily worked, requiring no machinery for pumping out water, &c. Sometimes pyrites of a tin white colour are found mixed among the coal, and

argillaceous iron ore, well adapted for working in the blast furnace, is one of the alternating strata. Coal is also dug at Zanesville, and Galliopolis, in Ohio, at Wellsburgh and Wheeling in Virginia, at Maysville and on Trade-Water River in Kentucky, at Alton in Illinois, and at Florissant and on Osage River in Missouri.

57. *Sulphate of Lime.* (Gypsum.)

This earthy salt is found in the crystallized form, in St Clair county, Illinois. It is also found on the south bank of the Arkansaw, near the Salines situated in that country. The quantity is immense, and there is an unusual proportion in the crystallized and transparent form. Mr. Sibley who visited that part of the country several years ago, in giving a description of it, says,—" It is a tract of about seventy-five miles square, in which nature has arranged a variety of the most strange and whimsical vagaries. It is an assemblage of beautiful meadows—verdant ridges, and rude misshapen piles of red clay, thrown together in the utmost apparent confusion, yet affording the most pleasing harmonies, and presenting in every direction an endless variety of curious and interesting objects. After winding along for a few miles on the high ridges, you suddenly descend an almost perpendicular declivity of rocks and clay, into a series of level and fertile meadows, watered by some beautiful rivulets, and here and there adorned with shrubby cotton trees, elms, and cedars. These meadows are divided by chains formed of red clay, and huge masses of gypsum, with here and there a pyramid of gravel. One might imagine himself

surrounded by the ruins of some ancient city, and that the plain had sunk by some convulsion of nature more than one hundred feet below its former level, for some of the huge columns of red clay rise to the height of two hundred feet perpendicular, capped with rocks of gypsum, which the hand of time is ever crumbling off, and strewing in beautiful transparent flakes, along the declivities of the hill, glittering like so many mirrors in the sun."

58. *Sulphate of Magnesia.*

This salt occurs in beautiful white crystals, in a cave near Corydon, the present seat of government of Indiana.

59. *Pumice.*

This volcanic mineral is annually brought down the Missouri River, by the flood which generally happens in June. Of its origin we know nothing. Hunters speak of a mountain emitting smoke and flames on the head of the River Kanzas. The same phenomenon is reported to exist on the waters of the Yellowstone. The pumice is well characterized, consisting of a light spongy mass of vitrified matter, made up of minute globules, or spheroids of a grayish white colour; sometimes it is brown, red, or black. There is also brought down the same river, a volcanic production, light enough to swim on water, which does not appear to be pumice. It is probably a pseudo-volcanic product, originating from the accidental burning of coal, barks, &c.

60. *Basanite.* (Touchstone.)

On the banks of the Mississippi, are found numerous pieces of a close grained, dark silicious

slate, which receive the trace of metallic substances rubbed against them with great facility, and afford a true evidence of the colour of the metal employed. They occur in rolled pieces on the shores of the river, where they are deposited by the high spring floods, and are brought down with innumerable other fragments of stone, from the unexplored regions, which give rise to the Missouri and the Mississippi, with their remotest tributaries. The several masses, though amorphous in some instances, have in others, a trapezoidal configuration, and they are sufficiently soft, to admit of being ground on a common grindstone.

61. *Greenstone Porphyry.*

There is but one body of granitic rock in all the inhabited part of the Territory of Missouri. This occurs in high broken masses in the west part of Madison county, and continues for many miles into the adjoining county of Washington. It is one of the most rough and romantic scenes in all that country, and, considered with a view to its geological or mineralogical character, is by far the most interesting. It is completely insulated by secondary limestone. In it, are found many imbedded minerals, and the River St. Francis, which enters the Mississippi five hundred miles below, originates in springs which gush out among these stupendous piles of red granite. Ores of iron, lead, and zinc, with quartz, feldspar, shorl, mica, and graphite, are among the minerals furnished by that region, and greenstone, gneiss, and greenstone porphyry, are among the larger masses of rock. The greenstone is found in large insolated

fragments lying promiscuously among the fragments of granite, which have tumbled down from the lofty cliffs above. It would probably be found constituting veins in the granite of that place, were a diligent search instituted, but I did not observe any in that situation. It is most commonly rendered *porphyritic* by crystals of green and flesh coloured feldspar, variously shaded and blended into one another. The greenstone itself is a very dark green, inclining to black. It breaks with the most extreme difficulty, sometimes exhibiting small specks of tin-white pyrites.

62. *Schorl.*

Imbedded in certain granitic aggregates in Madison county, Missouri Territory, are found ill-defined crystals of common black schorl, which approach in figure, a six-sided pyramid, terminated by three lateral faces, so modified by truncation, as to elude description.

63. *Ochre.*

About six miles west of the Chalk Banks on the Mississippi, in the interior of Cape Girardeau county, Missouri Territory, are found some beds of variously coloured ochres, which consist principally of the oxyd of iron, combined with various proportions of silex and alumine, all in a state of intimate comminution and mixture. These ochres, which are red, white, yellow, &c. may probably be found useful as pigments, and indeed, they have already been applied with some success to that use, by the inhabitants of that neighbourhood.

64. *Agate.*

A specimen of this mineral now before me, I picked up on the highlands south of White River, in Arkansaw Territory, and about three hundred miles west of the Mississippi. It is nearly the one equal fourth part of a nodular mass, broken during that physical revolution of the earth, which left the alluvial soil upon the rocks, where, with other silicious matters, it occurs as a deposit. Its colour is a purple of the highest beauty, pervaded by white stripes, or zones, which are arranged in concentric curves corresponding with the exterior indented surface.

65. *Onyx.*

This variety of agate is found in Missouri, on the west bank of Establishment Creek, eight miles from St. Genevieve. on the road to Potosi. Its colour is a bluish white, which passes into pale blue, and dark blue, and the colours are variously arranged in stripes, zones, or concentric lines. It appears in detached masses on the surface of the ground, and associated with chalcedony and hornstone. The rock formations at that place, are secondary limestone, overlaying white sandstone. The hardness of this mineral is one of its most distinguishing properties. It strikes fire readily with steel, and from some trials instituted by Mr. Lucius Bull, of this city, whom I had furnished with specimens of the rough mineral, it appears capable of receiving a high polish.

66. *Shale.*

Shale is one of the alternating mineral strata, in the Independent Coal formation at Pittsburgh, and

is common at all the coal mines, so numerous in that vicinity. It lies next to the coal, and passes on the one hand into argillite, and on the other into bituminous shale. A decomposition has in some instances taken place, the result of which is a clay of a bluish white colour, soponaceous to the feel, and plastic.

67. *Buhrstone.* (Millstone.)

Racoon Creek, in Indiana, is noted throughout the western country, for the buhrstone procured on its banks, and which is now a profitable branch of manufacture. It covers an area of from ten to fifteen acres square. Its texture is vesicular, yet it is sufficiently compact to admit of being quarried with advantage, and the stones are applied to the purposes of milling with the best success. Laurel Hill in Virginia, is also noted for the millstones procured there, but I did not take that place in my tour, and cannot state any particulars respecting their geological position. The stone appears, from a manufactured specimen which I have seen, to be a pretty compact variety of that kind of vesicular quartz, called *buhrstone.*

68. *Hydrogen Gas.*

A phenomenon which has for several years excited the attention of travellers, under the name of a *burning spring*, exists on one of the principal forks of Licking River, Kentucky. It is situated about three fourths of a mile from the banks of the river, and about eighty miles above its junction with the Ohio, opposite Cincinnati. A spring here breaks out at the foot of a hill, forming a basin of water about six feet in diameter, and two feet

deep, at the bottom of which, issues a stream of hydrogen gas, which in volume and force, is about equal to the blast forced from a common smith's bellows, but there is no cessation of its force, which is such as to create a violent ebullition in the water. Being heavier than common atmospheric air, the gas on passing up through the water, constantly occupies the surface, which is still the lower part of an indenture in the earth at that place. On presenting a taper, this gas instantly takes fire, and burns with great brilliancy. There is no absorption of it by the water, which possesses the purity of common spring water; neither is any offensive odour thrown off,—a circumstance which leads me to conclude, that it is *carburetted hydrogen*, which is probably liberated by the spontaneous operation of physical agents on a stratum of stone coal at some depth below.

This spring has been known to dry up entirely in the summer, when the air rushes out with increased force, accompanied by a hissing noise. There is nothing like smoke emitted; a fresh peeled sapling, held over the flame, does not receive the least colouration, and meat may be roasted over the flame without contracting any disagreeable flavour.

69. *Native Iron.*

A mass of native iron weighing upwards of three thousand pounds, was discovered several years ago, on the banks of Red River, in Louisiana, and is now in the collection of the Historical Society in the New-York Institution. Its shape is irregular. inclining to oviform, its surface deeply indented

and covered by an oxyd of iron, and it is much broader at the bottom, where it has rested on the earth, than at the top, inclining somewhat in the manner of a cone. By several experiments which have been made upon different pieces of it, there appears to be a want of uniformity in its quality, some parts being very malleable and ductile, while others possess nearly the hardness of steel. It is susceptible of the highest polish, and is said to contain some nickel. Col. Gibbs, through whose munificence this rare specimen of the physical productions of our country has been placed among the collections of the Historical Society, has discovered in its interior, octahedral crystals of singular beauty, some of which are half an inch in length, and striæted.

This mass of iron was found about one hundred miles above Natchitoches, on Red River, on one of those rich and extensive prairies so common to that part of the country, and about twelve miles from the banks of the river. Other pieces have been found in that neighbourhood, and if reliance is to be placed on information from travellers into that quarter, very large masses of native iron now exist there.

Remarks.

In the arrangement of the preceding Catalogue, no order has been observed. Species, subspecies, and varieties, differing widely in their nature and composition, are promiscuously treated, and succeed each other without any regard to mineralogical method. I sat down to write with my collection of western minerals before me, taking up

one after another, as they happened contiguous, and successively recorded their localities, and packed them away. Such is the simple method I adopted, and now that I have gone through, I am not sensible that a new arrangement of the matter would materially affect its utility. The labour which it would be necessary to bestow in re-writing the article, would at least be disproportionate to the benefits expected to result from it. It must therefore go to the press in its present shape. It contains such information on the mineralogy of the western country, as I had to give, and I must leave it to those who may feel interested, to pick out, arrange, and apply it.

It is not pretended that the foregoing Catalogue embraces *all* the minerals of the western country. On the contrary, there is reason to conclude, that only a small portion of them have been noticed. Such only as I have seen, or procured specimens of, or of whose existence I am certified by concurrent testimonies, I have mentioned, adding such reflections as appeared to me to be proper. It is therefore rather the Catalogue of such minerals as I collected on my tour, than any attempt to embody all the known localities of minerals of that extensive country through which I passed. Many others might have been added from received authority, but I preferred making out the record of a few localities well known, than of many whose existence, character, and extent, are involved in doubt. It is the commencement of an investigation into the physical history, character, and resources of the western country, and which is left

to future observation to continue and perfect. The field is an extensive one, and invites attention; and I only regret the insufficiency of my means, to continue inquiries so full of interest, and so nearly allied to the wants, comforts, and independence of our country. I must content myself therefore, with having been the pioneer of western science, without the advantages resulting from its regular march, and of having endured many of the difficulties, connected with a frontier tour, with the expectation of few of its advantages.

ARTICLE III.

JOURNAL

OF A

VOYAGE UP THE MISSISSIPPI RIVER,

FROM THE MOUTH OF THE OHIO TO ST. LOUIS,

WITH SOME ACCOUNT OF THAT PLACE.

July 1, 1818. The dashing of oars awoke me this morning at an early hour, and on quitting my birth, I found the boat under rapid headway for the mouth of the Ohio, with the Mississippi in full view. The interest excited on approaching the junction of these celebrated rivers, and a wish to survey with attention the physical character of the country, kept me constantly on deck. The morning was calm and serene, scarcely a cloud obscured the atmosphere, and the sun rose majestically above the horizon, clothing in light the most sublime and beautiful scene, which, until that moment, I ever beheld. The novelty of the scenery, the bold geographical outlines presented by the banks of the rivers, the heavy forests which cast their gloomy shadows upon the water, and the low

murmur of two mighty streams hastening to mingle their currents, could not fail to present a scene replete with the highest interest, and capable, at once, of exciting our united wonder and admiration. Yet, I could not contemplate the junction of these two streams without feeling something like regret or disappointment, not because the scene did not equal the expectations I had formed of it, for it was all I had anticipated, but it arose from the termination at that place of a beautiful river, which in my descent had afforded me so much pleasure, and of which I wished to see more, —it arose from the submersion and loss of the gentle and clear Ohio in the rapid and turbid Mississippi. After having pursued the Ohio from Pittsburgh to its mouth, a distance of more than one thousand miles, and seeing it successively swelled by the Sciota, the Muskingum, the Miami, the Kanhaway, Kentucky, Green, Wabash, Cumberland, Tennessee, and numerous other rivers, of scarcely inferior magnitude, the traveller is insensibly led to a contemplation of its grandeur and beauty; he feels a mingled emotion of pride and satisfaction in riding down its majestic current, and cannot help feeling something like regret, to find it, at last, merely a tributary to the Mississippi—that mighty stream which draws its waters from a country equal in extent to the Roman Empire in its proudest days; and whose tributaries are rivers surpassing in size the Rhine, the Danube, or the Wolga. Such at least were my emotions on reaching the Mississippi, which w · entered this morning at sunrise, and found ourselves

suddenly transported from a gentle current and clear water, to a stream holding so much mud in suspension as to appear perfectly opaque; and a current so rapid that it is with difficulty navigated by ordinary boats.

Made this day five miles. Banks of the river a rich black alluvion, elevated from ten to fifteen feet above the water.—Trees chiefly cotton wood. Left at the mouth of the Ohio about twenty boats of all denominations, laden with merchandise, and emigrant passengers, chiefly destined for Boon's Lick on the Missouri.

Thursday, 2*d July*. Soil and timber the same as yesterday. Banks twenty feet high on an average, and subject to semi-annual inundation. We have suffered excessively this day from musquitoes, and they are now in swarms around the boat, so that I promise myself little sleep this night. Ascended six miles.

Friday, 3*d July*. We have this day passed several islands covered with a rank growth of young cotton wood trees, and passed for several miles along a shore rendered dangerous by *sawyers*, *planters*, and *snags*. As these terms may not be familiar to an eastern reader, an explanation may here be given. A sawyer is a large tree which has tumbled into the river above, and got fastened by its roots in the bottom, with its top pointed downwards, and just appearing above the level of the water, or it may terminate a foot or two below, so that its locality can only be told by an experienced hand by the ripple created in the water. This tree is continually forced downward by the

current, which is still not strong enough to tear it out, and suffers it occasionally to recoil, so that a regular rotatory motion is kept up, which is performed once in ten or fifteen minutes; and if a boat be passing over it at the time it has overcome the pressure of the current and is recoiling to its original position, the destruction of the boat is inevitable. The power of this engine of destruction is that of elasticity, which is here brought into operation by the pressure of water against a column of live wood eighty or ninety feet in length, the bottom being fastened, and the column inclined at an angle of about eighty degrees, leaving the top at liberty to play like a whip-stalk. When the tree does not reach within two or three feet of the surface of the water, they are called *sleeping sawyers*, and these are the most dangerous, for they cannot be seen. It was on one of these that the steam boat Franklin struck, and sunk, a few miles below St. Genevieve.

Planters, are trees in a similar situation, but firmly set, and having no motion. *Snags*, are small trees, or limbs of large trees, sticking up in the river, and may either be fixed or have motion.

Ascended this day seven miles, and came to, at night, at the foot of a large island, covered with the reed, or cane, a plant which has been common, as the undergrowth, on both banks of the river, from the mouth of the Ohio thus far up.

Saturday, July 4th. Independence. To testify their observance of this day, the boatmen made their appearance this morning in *clean shirts*, and were indulged with an extra dram by the captain.

I could not help thinking it less a tribute of honour to the day, than a comfort to themselves. There has thus far been a great uniformity in the appearance of the country. The banks, however, begin to rise, and from the appearance of the wild turkey and gray squirrel on the shore, it is probable we are passing out of the inundated region. Ascended six miles.

Sunday, July 5th. A storm coming on suddenly last night, and the waves beginning to rise, we were compelled to make land on a falling-in bank, at the head of a large island, and where we lay all night in imminent danger of being crushed by the falling earth, or sunk by the violence of the waves. These banks are created by the current of the river being altered, (which generally happens during the high spring floods,) and thrown forcibly against the head or side of islands or banks, which are continually undermining and tumbling in, so that whole islands are thus swept away, and deposited at some other place, where the current favours the increase of some head land, or the formation of new islands.

Ascended this day eight miles, which brought us to the first settlement at Tyawapaty Bottom. Here are six or eight plantations, where corn, flax, hemp, tobacco, pumpkins, potatoes, &c. are raised in abundance. The lands are said to be too rich for wheat. The peach and apple tree succeed very well, and among the wild fruits, the blackberry, papaw, percimmon, crab apple, and haws, are abundant. This is the first spot of land sufficiently elevated to admit of successful cultivation.

and is exempt from inundation, except in *uncommon rises*, when it is overflown for a short period, from one to two feet.

Monday, July 6th. No change in the face of the country. Settlements continue on the Missouri shore, and the land gradually rises. Ascended three miles, and lay by, *waiting for hands*, our crew being found too weak to work the boat with advantage. While moored to the bank this day, we were overtaken and passed by, a boat loaded with pine boards and plank from Olean, on the head of Alleghany River, in Cattaragus county, state of New-York, and destined for St. Louis. On inquiry, I learned that a considerable commerce in these articles was carried on; and that a handsome profit attended the business. The boards and plank are taken in rafts from Olean, to the mouth of Ohio, and from thence carried in keel boats and barges to St. Louis, where they are worth sixty dollars per thousand feet.

Tuesday, July 7th. Early in the morning arrived at the head of Tyawapaty Bottom, at the Little Chain of Rocks, where the western, or Missouri bank of the river presents an elevated ridge, with a rocky front to the river, and covered at top, with a stratum of sterile alluvion, consisting of pebbles. and chips of hornstone in a red clay, which affords nourishment to a stinted growth of oaks, some walnut, sassafras, and a few other trees and plants peculiar to the poorer kinds of soil. This is the first high land met with from the mouth of the Ohio, from which it is situated thirty-five miles, and fifteen miles below Cape Girardeau.

Half a mile above the Little Chain of Rocks, are situated the Chalk Banks, where chalk of a good quality is procured, and much of the chalk consumed in the interior of Missouri, is procured at that place. The beds are extensive, and the chalk is raised with very little expense. Pervading it, are found strata of flint, from two to four inches in thickness; and I also procured some specimens of flint in the nodular form, inveloped by chalk, or a calcareous matter resembling chalk. There is also found here, yellow and red ochre, and large masses of puddingstone are found on the margin of the river. It consists chiefly of silicious pebbles, and sand, cemented by iron. Ascended ten miles.

Wednesday, July 8th. Limestone rocks, and hilly grounds, covered with oak, with occasional strips of bottom land, continue on the Missouri shore. On the eastern or Illinois shore, the country has been wholly of alluvial formation, presenting a rich level plain, covered by a heavy growth of cotton wood, sycamore, elm, &c. Generally, however, it appears too low for cultivation, and remains in the state of nature. On ascending five miles this morning, we reached the town of Cape Girardeau, which consists of about fifty houses, including two stores and a post office, and is situated on an eminence commanding a delightful prospect of the Mississippi for several miles below, and of the country of the Illinois beyond. It was formerly the seat of justice for Cape Girardeau county, Missouri Territory, but according to a late law, it

has been removed to Jackson, a flourishing town situated twelve miles west of the river.

The town of Cape Girardeau, is situated fifty miles above the junction of the Ohio and Mississippi, and about eighty miles below St. Genevieve. We have thus far experienced a strong current, many shoals, sand bars, falling-in banks, and rafts of trees, snags and sawyers without number.

Thursday, July 9th. The mineralogical character of the western bank of the river, is becoming more interesting. Some pieces of hornstone, jasper, radiated quartz, and argillaceous oxyd of iron, have rewarded my rambles this day. The rock formations are invariably limestone, chiefly secondary, resting on red sandstone. These rise, in some places, in perpendicular bluffs on the banks of the river, and at others, recede for half a mile, or a mile, giving place to a rich bottom of alluvial formation, which is generally elevated above the periodical floods. Some farm-houses are scattered along the shore, surrounded by the most luxuriant corn-fields. Corn appears to be the staple article of the farmer, although wheat succeeds very well in Cape Girardeau county generally, particularly in the interior, where considerable quantities are raised. Ascended seven miles.

Friday, July 10th. Rocks continue on the Missouri shore, and have presented a perpendicular wall for the greatest part of the day, presenting in some places, the most novel, terrific, and enchanting views. Picked up a large fragment of pumice, well characterized, which is annually brought down the Missouri River, as the boatmen

say, from the unknown countries at its head, where volcanic fires are said to exist. Ascended seven miles, and encamped at the *Mockason Spring*, a basin of limpid water, occupying a crevice in the rock, and well known among the navigators of the Mississippi, for the cooling beverage it affords.

Saturday, July 11*th.* We were passed this day by the steam-boat Harriet, laden with merchandise for St. Louis. Face of the country unaltered. Some plantations on the Illinois shore. Ascended five miles.

Sunday, July 12*th.* Passed the mouth of Great Muddy River, a considerable stream of Illinois, and whose banks afford large beds of good inflammable stone coal. Several pieces of native copper have also been found near the margin of this river. Directly opposite the mouth of this river, on the Missouri shore, is found a bed of chalk, similar in appearance to that procured at the Little Chain of Rocks, in Cape Girardeau county. Two miles more brought us to the *Grand Tower*, one of the wonders of the Mississippi. It is a stupendous pile of rocks, rising out of the river, nearly midway of the stream, of a form nearly circular, and rising somewhat in the shape of a cone, to the height of about one hundred and fifty feet, and capped by a stinted growth of cedars. It seems in connexion with the rocky shores on either side, to have opposed, at some former period, a barrier to the progress of the Mississippi, which must here have had a perpendicular fall of more than one hundred feet.

In the rocks on the Illinois shore, and directly opposite the Grand Tower, is a large crevice, called the *Devil's Oven*, which is less remarkable for any thing wonderful or terrific in its appearance, than for *its name*. It may also claim notice from being the first rock or highland on the Illinois shore from the mouth of the Ohio, thus far up. A chain of hills coming from the southwest, appears to have crossed the Mississippi at this place, pursuing its way into Illinois, first in a northeast direction, then stretching towards the northwest, and forming the eastern shore of the Illinois River, as far as observation has extended. By some convulsion of nature, or the continued power of friction acting for centuries upon a limestone rock, the Mississippi has here forced its way through that barrier, leaving the Grand Tower as a perpetual monument of that sublime physical revolution. Ascended seven miles, and encamped in the eddy below Cape Garlick, after having made three unsuccessful attempts to pass it.

Monday, July 13th. On a renewed attempt this morning, we succeeded in doubling the Cape, not, however, without incredible fatigue, and the loss of two of our best hands, who refused to proceed any further; were paid off, furnished with provisions, and immediately commenced their journey back. Ascended half a mile further, and came to, at the mouth of the Obrazo, a small river, entering on the Missouri shore. It originates in broken lands in the southwestern corner of St. Genevieve county, and affords near its mouth, a fine body of choice farming lands. While moored

to the bank here, waiting the arrival of additional hands from the interior, we were passed at different periods, by four boats, chiefly laden with furniture, and emigrants from Vermont, and the western part of New-York, destined for Boon's Lick, on the Missouri.

Tuesday, July 15th. Rocks occasionally on both sides of the river, with some bottom lands, and a few plantations intervening. Ascended six miles.

Wednesday, July 15th. Scenery unaltered. Nothing can equal the beauty of the varying landscape, presented for the last two days. There has appeared a succession of the most novel and interesting objects which the face of nature is capable of presenting. Whatever pleasure can be derived from the contemplation of natural objects, presented in surprising and picturesque groupes, can here be enjoyed in the highest degree. Even art may be challenged to contrast with more effect, the bleak and rugged cliff with the verdant forest, the cultivated field, or the wide extended surface of the Mississippi, interspersed with its beautiful islands, and winding majestically through a country, which only requires the improvements of civilized and refined society, to render it one of the most delightful residences of man. Nor is it possible to contemplate the vast extent, fertility, resources, and increasing population of this immeasurable valley, without feeling a desire that our lives could be prolonged to an unusual period, that we might survey, an hundred years hence, the physical and political condition of this country, and live to participate in the advantages, improve-

ments, wealth, glory, and power, which is destined to crown the great basin between the Alleghany and Rocky Mountains, the first kingdom upon the globe. Ascended seven miles.

Thursday. July 16th. The western shore of the Mississippi has been unusually rugged and barren this day, presenting one continued wall of limestone, and but little ground which is capable of cultivation. Cape St. Comb, which we passed at noon, is remarkable for the large fragments of sandstone rock, which are lying there in the most promiscuous manner. Some pieces of it, may be considered granular quartz. We frequently meet the *paroquet* on the banks of the river, and have passed several large flocks to-day. This is a kind of parrot, a beautiful bird, which is very common in Louisiana, Missouri, and Kentucky. We have also met in this day's voyage, a large flock of pelicans, but could not approach nigh enough to kill any. This is a bird which frequents the waters of the Mississippi, but never ventures far into the interior. The wild turkey, quail, and squirrel, are daily met with on either shore, and we find no difficulty in killing as many as we have occasion for. Ascended ten miles, and encamped at the foot of Bois Brula Bottom.

Friday, July 17th. We have this day passed by a considerable part of Bois Brula Bottom, which is one of the most fertile tracts of alluvial soil in St. Genevieve county. It extends for twelve miles along the margin of the river, and is a populous and flourishing settlement. Ascended seven miles

and encamped, some of the hands complaining of sickness.

Saturday, July 18th. At an early hour this morning, we passed the mouth of the Kaskaskia, or Ocaw River, a large stream running in from the Illinois shore. It is a hundred yards wide at its mouth, with an average depth of eight feet of water, and originates in the highlands east of the Illinois River, about two hundred and fifty miles northwest of its junction with the Mississippi. Kaskaskia, one of the oldest towns in Illinois, and the present seat of the territorial government, is situated on this river, seven miles from its mouth, and the river will admit of being navigated with steam boats to that place. Ascended seven miles.

Sunday, July 19th. From the head of Bois Brula Bottom, to the commencement of the great field of St. Genevieve, a distance of six miles, the country is rough and unsettled. Here commences a rich tract of alluvion, which extends to the town of St. Genevieve, a distance of five miles, and is cultivated in common by the inhabitants. Ascended this day eleven miles, which brought us to the St. Genevieve landing, at the mouth of the Gabbarrie, a small creek running through the town. The town of St. Genevieve lies on an eminence, a mile west of the landing, and consists of about three hundred houses, including several stores, a post-office, court-house, jail, and Roman Catholic chapel. It is one of the principal markets for the Missouri lead mines, and carries on a considerable commerce with the interior, supplying foreign merchandise to the inhabitants, and taking lead,

corn, wheat, whiskey, pork, beef, deer skins, and peltries in return. A branch of the Missouri bank, with a capital of $50,000 is also established at this place.

Monday, July 20th. At St. Genevieve. The water of the Mississippi is falling rapidly, and leaves on the shores a deposit of mud, which, is in various places from a foot to two feet in depth. This recent deposit appears to consist essentially of silex and alumine, in a state of very intimate mixture. An opinion is prevalent throughout this country, that the water of the Mississippi, with every impurity, is healthful as a common drink, and accordingly the boatmen, and many of the inhabitants on the banks of the river, make use of no other water. An expedient resorted to at first, perhaps, from necessity, may be continued from an impression of the benefits resulting from it. I am not well enough acquainted with the chymical properties of the water, or the method in which it operates on the human system, to deny its utility, but to my palate, a glass of cool, clear spring water, is far preferable to the muddy lukewarm water of the Mississippi. I have seen a simple method pursued for clarifying it. It is done by sprinkling a handful of *Indian meal* on the surface of a pail of water, which precipitates the mud to the bottom, and the superincumbent water is left in a tolerable state of purity.

Tuesday, July 21st. While lying at St. Genevieve yesterday, we were passed by several keel boats, and barges with emigrants, merchandise, pine plank, from Olean, &c. all destined for St. Louis.

Among the number of emigrants with whom I conversed, were several from the District of Maine, from Vermont, Connecticut, New-York, Pennsylvania, North Carolina, and Kentucky; whose destination was chiefly Boon's Lick, on the Missouri. On ascending three miles above St. Genevieve this morning, we came to the *Little Rock Ferry*, where the west bank of the river presents a wall of limestone, which continues for several miles up. At this place we had occasion to witness a remarkable instance of longevity in the person of M. Burton, whose age is stated at one hundred and nine years, and whose life has been spent in the fatigues and activity inseparable from the pursuits of a soldier and a hunter. He was at Braddock's defeat,—at the siege of Louisbourg,—at the taking of Bergen-op-Zoom in Flanders,—at the building of Fort Chartrès in Illinois, and was the discoverer of those rich and extensive lead mines in Washington County, which continue to be called after him. Ascended twelve miles.

Wednesday, July 22d. Limestone rock, washed by the river,—hills back covered chiefly with oak,—lands poor, and strewed with detached shivers of flint, and hornstone, which are sometimes accompanied by the *ancient Indian dart*, and radiated quartz. Those detached strips of alluvion, which occasionally intervene between the most prominent points of rocks, are covered by a very rank growth of plants, shrubs, and vines; among which the wild pea, and the hop, are conspicuous. The forest trees immediately bordering the river are cotton wood and sycamore, with

some papaw, buckeye, and hackberry. We were passed near evening by the steam boat Harriet, on her descent from St. Louis, and also by two keel boats, going to the mouth of Ohio for *pine plank.* The west banks of the river have this day presented some sublime views, particularly at a place called the *Dormant Walls*, which are elevated at least 200 feet above the water's edge, and bear the marks of attrition of some ancient ocean, to which it has served as the western barrier, and now bears a thousand fanciful forms, imprinted by the action of the water. Ascended thirteen miles.

Thursday, July 23d. The bold and rude scenery presented by the western bank of the river yesterday, has continued nearly all this day, sometimes rising into very high peaks, and at others graduating into gentle hills, covered with oaks, and bounded on the margin of the river by small alluvial tracts. Passed the mouth of the Platten Creek, Cornice and Swashing Rocks, and arrived at Herculaneum about mid-day. Distance five miles.

Herculaneum is a town of between 30 and 40 houses, and is handsomely situated on the west bank of the Mississippi, at the mouth of Joachim Creek. It has three stores, a post office, and school; and there are three shot towers, two flouring mills, a distillery, and tan yard in its vicinity. It is one of the principal markets for the Missouri Lead mines.*

Friday, July 24th. At Herculaneum. The boat unexpectedly ends her voyage at this place—cargo

* Herculaneum has since been fixed upon as the seat of justice for Jefferson County.

all discharged, and it returns. Directly opposite Herculaneum, on the Illinois shore, lies Harrisonville, a small town of about twenty houses, and the seat of justice for Monroe County, Illinois. It is situated on a tract of alluvial land called the American Bottom, which extends from the Kaskaskia river along the margin of the Mississippi for a hundred miles, and has a breadth of from three to ten miles. It is one of the richest bodies of land in the western country, producing all kinds of grain and fruits in great perfection and abundance. Its margin on the river is covered by a dark and heavy forest of trees, with a rank growth of underbrush; but at the distance of a mile, or a mile and a half from the banks of the Mississippi, the prairies commence, and extend to the rocky bluff by which the tract is bounded on the east.

Saturday, July 25th. At Herculaneum. This town is situated thirty miles below St. Louis, thirty above St. Genevieve, and one hundred and seventy above the junction of the Ohio with the Mississippi. The lead mines lie 35 miles southwest of it. The scite of this town has been chosen with a judicious eye; its local relation to the adjoining country being such as to render it the key to its commerce. It lies on a high level alluvial plain, environed on both sides by rocky bluffs, which appear here to have been placed asunder to allow the Joachim a passage into the Mississippi. These bluffs are crowned by shot towers, which add much to the picturesque appearance of the place, and afford the visitor a most enchanting view of the Mississippi river for many miles below and above;—

of its islands and banks—of the American bottom, and of the bluffs beyond.

The geological character of the western banks of the Mississippi, from the first highland which is met with at the Little Chain of Rocks, to this place, has preserved a great uniformity. The lowest stratum of rocks is a grayish yellow, or reddish sandstone, which passes in some places into a grayish white sandstone, coarse grained, and in others to a very fine white granular quartz. This is overlayed by transition, and secondary limestone, the latter being the highest and last deposit, containing numerous impressions of shells, animalcula, and plants. Primitive limestone (compact) is found on the bluffs back of this town.

Sunday, July 26th. Having no opportunity to continue my journey by water, I determined to pursue my way to St. Louis by land, and set out this morning, in company with two of my fellow voyagers, on foot, having taken directions as to the roads and distance. After travelling seven miles we arrived at the *Sulphur Springs*, a place which is occasionally resorted to on account of its medicinal properties. The water is pretty strongly impregnated with sulphur, and is supposed to have a beneficial effect in bilious complaints. The scenery in the vicinity of the springs is highly picturesque, and the place is susceptible of being made a delightful resort. Five miles more brought us to the banks of the Merrimack river, where we arrived at dark, and prevailed with the ferryman to take us across, notwithstanding the darkness of the night, and the rain, which after having threat-

ened a shower all the afternoon, now began to fall. Mistaking our way, however, on leaving the west banks of the river, we wandered about for two or three hours in the woods, the rain pouring in torrents, and the night so dark that we could only progress when the lightning served to show us the way; and at last found the house we were in search of. The Merrimack is a stream of two hundred yards across, and originates in high lands two hundred and fifty miles southwest of its junction with the Mississippi. It affords some fine bodies of land, and near its head are large forests of pine, which are destined to furnish boards and plank for building to a great portion of the surrounding country. Its banks also furnish large beds of iron ore, and manganese; and the extensive lead mines in Washington County are all situated on its tributary streams.

Our road this day has lain across a sterile tract of country, consisting of a succession of hills of moderate elevation, covered chiefly by oaks, and without underbrush. A tall, thick, and rank growth of wild grass, covers the whole country, in which the oaks are standing interspersed, like fruit trees in some well cultivated orchard, and giving to the scenery the most novel, pleasing, and picturesque appearance. Distance fifteen miles.

Monday, July 27th. On travelling twelve miles this morning, we arrived at the old French village of Carondalet, or *Vede-pouchè.* It lies immediately on the margin of the Mississippi, and contains about sixty buildings, exclusively occupied by the French, who are chiefly engaged in agriculture.

Nearly opposite Carondalet, on the Illinois shore, lies the town of Cahokia, the seat of justice for St. Clair County, Illinois. It has about one hundred houses including the county buildings, a post-office, a Roman Catholic chapel, and an office for the sale of public lands. The inhabitants are chiefly French. This town is the residence of the presiding judge of the Territory, the Hon. J. B. Thomas.

On quitting Carondalet, we entered upon an elevated tract of highland prairie, without forest trees, and covered by tall grass and shrubs. The road across this tract preserves a parallelism with the Mississippi, from which it is situated about half a mile, and affords several commanding prospects of that river, and of the country beyond. At the distance of three miles a sudden change is witnessed, and a rich tract of improved country, with numerous well constructed buildings, fences, orchards, &c. indicated our approach to St. Louis, where we arrived at about four o'clock, and enjoyed a serene evening, for viewing the town. Distance eighteen miles.

Tuesday, July 28th. Description of St. Louis. St. Louis is situated in Lat. 38° 36″ N. and Long. 12° 58″ W. from Washington City. It is built upon the west bank of the Mississippi river, eighteen miles below the junction of that river with the Missouri, and thirty miles below the mouth of the Illinois. It is twelve hundred miles above the city of New-Orleans, two hundred above the junction of the Ohio and Mississippi, and fifteen hundred miles, by computation. below the Falls of St. An-

thony. The town occupies an elevated plain in a bend of the river, which has a gradual ascent from the landing in front, to the rear of the town, where it terminates in a level and extensive prairie, or plain. This plain consists of a stratum of alluvial soil, bottomed on limestone rock, which forms a permanent shore in front of the town, and for several miles below and above it. It contains 5,000 inhabitants, and about 550 houses, a great proportion of which are well constructed buildings of brick or stone. Among the number, are 40 stores, a postoffice, a land office, two chartered banks—the Bank of Missouri, and the St. Louis Bank, and one private bank, called the St. Louis Exchange Bank. All the ordinary trades and callings, are established, and the mechanic industry of the place, supplies not only the necessaries, but many of the elegancies of life. It has one brewery, two distilleries, two water mills, one steam flouring mill, and a mill propelled by ox power. It has a court-house, jail, theatre, three churches, a museum, and several public schools, where not only the rudiments, but some of the higher branches of education are taught. The museum is the private property of Gov. Clark, through whose generosity visiters are gratuitously admitted to view the collection, which is arranged with great taste and effect, in the council chamber of his agency. The collection consists of numerous splendid Indian dresses, warlike instruments, skins of remarkable animals, minerals, fossil-bones, and other rare and interesting specimens, collected by him in his memorable tour to the sources of the

Missouri River, to the Rocky Mountains, and to the mouth of the Columbia River.

St. Louis is the seat of justice for St. Louis county, and the seat of legislation for the territory. It will also be the seat of government for the contemplated state of Missouri, and I anticipate the day, when it will be the seat of empire for that vast basin of land, situated between the Alleghany and Rocky Mountains on the east and west, and between the northern Lakes and the Gulph of Mexico on the north and south. Its situation in point of beauty, health, and convenience, is rarely equalled, and no place in the world, situated so far from the ocean, can at all compare with it, for commercial advantages. It is so situated with regard to the surrounding country, as to become the key of its commerce, and the store-house of its wealth, and if the whole western region be surveyed with a geographical eye, it must rest with unequalled interest on that peninsula of land formed by the junction of the Missouri with the Mississippi, a point occupied by the town of St. Louis. Standing near the confluence of such mighty streams, an almost immeasurable extent of back country most flow to it with its produce, and be supplied from it, with merchandise. The main branch of the Missouri is navigable two thousand five hundred miles, and the most inconsiderable of its tributary streams, will vie with the largest rivers of the Atlantic states. The Yellowstone, which enters the Missouri 1,800 miles from its mouth, is itself navigable 800 miles.—The La Platte—the Kanzas—the Osage—the Soo—the White Stone—

the Manitow—and the Gasconade, are all navigable from 300 to 700 miles, and flow through a country rich in all the productions of a climate the most genial, healthy, and serene. The Missouri, and its tributary streams, will supply navigation to a district of country 600 miles wide, and 2000 miles in extent. The Mississippi is navigable without interruption, 1000 miles above St. Louis. Its tributaries, the Corbeau, Iowa, Ousconsin, St. Pierre, Rock River, Salt River, and Desmoines, are all streams of the first magnitude, and navigable for many hundred miles. The Illinois is navigable 300 miles, and when the communication between it and Lake Michigan—between the Mississippi, and Lake Superior, and the Lake of the Woods—between the Missouri and the Columbia—between the Yellowstone and the Multnomah, shall be effected, communications not only pointed out, but almost completed by nature, what a chain of connected navigation shall we behold? and by looking upon the map, we shall find St. Louis the focus where all these streams are discharged, the point where all this vast commerce must centre, and where the wealth, and the refinements, flowing from these prolific sources, must pre-eminently crown her the queen of the west.

The valley of the Missouri in point of fertility, will well compare with the delta of the Nile, and lies mostly under a climate which is a medium between the cold winters of New-England, and the hot summers of Georgia. The soil is adapted to the raising of corn, wheat, rye, oats, flax, hemp, and tobacco. The flax and hemp of Boon's Lick,

is generally noted for its vigorous growth, and the fineness and flexibility of its fibres. The soil appears also peculiarly adapted to corn, which attains an almost incredible height, and yields abundantly. Some of the stalks will measure twenty feet, and as high as ninety bushels have been gathered from an acre, on the average of a large field together. Emigration is now flowing into this region with unexampled rapidity, already do settlements extend to the mouth of the Osage and Mine Rivers, and several towns are in the most flourishing condition. The principal of these are, Franklin, St. Charles, and Chariton, and should emigration proceed at the rate now indicated, fifty years will behold the banks of the Missouri from its mouth, to the La Platte, one of the most populous and well cultivated tracts in the western country. On the Mississippi also, we see the march of emigration, and the progress of improvement. The country is already settled as high as Salt River, which is bordered by a fertile and extensive tract of land, and the settlements at Prairie Du Chien are in a very promising state of advance. It is probable this place will be chosen as the seat of territorial government, whenever it becomes expedient to erect a separate executive department for the government of the Northwest Territory.

By extending our military post to the Yellowstone, and the Falls of St. Anthony, the fur trade of the northwest regions, and the Upper Missouri, which is now engrossed by the British traders, and carried on through the Lakes and Montreal, will

in few years, be turned into its natural channels. the Mississippi, and the Missouri. St. Louis will then become the great depôt of this trade, as Montreal is now, and by the supplies it will furnish, and the furs and peltries it will receive in return, will add yearly to its wealth and increase. This measure will also be attended with the most important benefits to the frontier settlements, who will thereby be protected from savage invasions and wars, and be enabled to extend themselves into countries, which would otherwise remain a wilderness for at least half a century longer. The copper mines of Lake Superior, the lead mines of Prairie Du Chien, and of Washington county, with the mines of coal, iron, zinc, manganese, and other minerals which abound in this country, are also destined to accelerate its march to wealth, civilization, and refinement, and a considerable part of the advantages arising from these, must always concentrate at St. Louis.

ARTICLE IV.

TOPOGRAPHICAL ACCOUNT OF WHITE RIVER,

IN

ARKANSAW TERRITORY.

In order duly to estimate the magnitude, position, character, and importance of any of our great western rivers, it is necessary to consider the relation they bear to each other, and to the surrounding country. A mere topographical description of an insulated section of country, a mountain, a stream, or a mine, may possess its value, but without a survey, however cursory, of the contiguous regions, it must lose much of its interest to the general reader, and much of its utility to the geographical student. It will be necessary therefore, to cast a glance at the extensive country, in which this river lies, before its individual consideration can be profitably commenced.

In looking on the map of ancient Louisiana, the most striking physical trait presented, is the Rocky, or Chippewan Mountains, extending from Mexico into the unexplored regions north and west of Lake Superior, with the Del Norde, Red River, the Arkansaw, the Kanzas, La Platte, and Yellowstone, all issuing from its sides near the same point, and uniting, (with the exception of the former,) at dif-

ferent points in the vast basin below, with the Missouri, the Ohio, and the Mississippi, in whose congregated flood they roll on to the Mexican Gulph. Other streams traverse that country, but these are the only rivers of Louisiana, whose heads rests on the Chippewan Mountains. Immediately at the foot of these mountains, commences the almost interminable plains of sand, or desert, which stretches from north to south, for more than a thousand miles, and has an average breadth of six hundred. To this succeeds the highlands and mountains of the present territories of Missouri and Arkansaw, and which preserve a pretty exact parallelism from north to south, with the Chippewan chain, and give rise to several rivers of secondary magnitude. This is again bounded by the alluvial tract of the Mississippi, being the third grand parallel division, presented by the surface of the soil. Through these the Red River, and the Arkansaw, hold their unaltered course, and reach the Mississippi without a fall; while the Kanzas, the La Platte, and the Yellowstone, bending northward, reach the Missouri, without meeting any mountains to oppose their progress. Those rivers of secondary magnitude, and whose origin is east of the highlands bordering the western desert are the Teche, Vermillion, Tensaw, Washitaw, Little Missouri, Courtableau, Bœuf, Crocodile, Little Red, Grand River, White River, Black River, the Osage, Merrimack, Gasconade, and St. Francis. Of these, White River, a stream hitherto almost wholly unknown, or only known to hunters, and which has not received its deserved rank on any existing map,

is one of the most considerable. It was therefore with surprise, that I found on travelling into those remote regions, so considerable a stream, unnoticed by geographers, or only noticed, to attest their want of information respecting its length, size, tributaries, character, productions, and importance. I therefore concluded, that a summary of these particulars, as observed by myself during a tour into that quarter, would be an acceptable piece of service, and with this view, began these observations.

White River originates among the Pawnee Mountains, near the 97th degree of west longitude, and about the 36th of north latitude. And after running in a very serpentine course for thirteen hundred miles, enters the Mississippi, fifty miles above the mouth of the Arkansaw, and seven hundred above New-Orleans. Its waters, unlike most of the western rivers, are beautifully clear and transparent, being wholly made up of springs which gush from the flinty hills that are found for more than half its length, within a few miles of, and often immediately upon its banks. So much of the country through which it runs, is therefore sterile and rough, but the immediate margin of the river, uniformly presents a strip of the richest alluvial bottom land from a quarter of a mile to a mile and a half in width. On this, corn, wheat, rye, oats, flax, hemp, and potatoes, have a vigorous growth, the mildness of the climate, and the fertility of the soil combining to render it one of the most favourable of all countries for the pursuits of agriculture. Cotton also succeeds on the

banks of this river as high up as settlements have extended, and will hereafter be an important item among its agricultural productions. The district of tillable land on this river, like many others west of the Mississippi, is chiefly confined to its banks, which in few instances exceed a mile in width. Bordering this, is found a chain of hills on either side, which sometimes close in upon the river's banks in perpendicular cliffs, and the adjacent country may in general be considered as sterile. To this remark, all its tributaries may be considered as exceptions, for they invariably afford, however small, strips of the most fertile lands, covered with a heavy growth of forest trees and underbrush. The cane is also common to this stream in its whole course, and affords a nutritious food for cows, horses, and hogs, who are fond of, and fatten upon it. This plant being an evergreen, cattle may feed upon it all winter, and it is accordingly given to cattle and horses, by the Indians and hunters, as a substitute for hay.

The only inhabitants on the upper parts of White River, so far as inhabitants have penetrated, are hunters, who live in camps and log cabins, and support themselves by hunting the bear, deer, buffaloe, elk, beaver, racoon, and other animals who are found in great plenty in that region. They also raise some corn for bread, and for feeding their horses, on preparing for long journeys into the woods, or other extraordinary occasions. They seldom, however, cultivate more than an acre or two, subsisting chiefly on animal food and wild honey, and pay no attention to the cultivation of

garden vegetables, if I except some cabbages, noticed at a few habitations. When the season of hunting arrives, the ordinary labours of a man about the house and corn-field devolve upon the women, whose condition in such a state of society may readily be imagined. They in fact pursue a similar course of life with the savages; having embraced their love of ease, and their contempt for agricultural pursuits, with their sagacity in the chace, their mode of dressing in skins, their manners, and their hospitality to strangers.

The furs and peltries which are collected during repeated excursions in the woods, are taken down the river at certain seasons in canoes, and disposed of to traders, who visit the lower parts of this river for that purpose. Here they receive in exchange for their furs, woollen cloths, rifles, knives and hatchets, salt, powder, lead, iron for horse shoes, blankets, iron pots, shoes, and other articles of primary importance in their way of life. Those living near the cultivated parts of Lawrence County, in Arkansaw Territory, also bring down in exchange for such articles, buffaloe beef, pork, bears' meat, bees' wax, and honey; which are again sold by the traders along the banks of the Mississippi, or at New-Orleans. Very little cash is paid, and that in hard money only, no bank bills of any kind being taken in that quarter. I happened to be present, on my return from the head waters of White River, at one of these exchanges, where a further opportunity was offered of observing the manners and character of these *savage Europeans.* Bears' meat was sold at $10 per cwt.

buffaloe beef at $1; cows' beef at $3; pork, in the hog, at $3.50; venison hams at 25 cents each; wild turkies the same; wild honey at $1 per gallon; beaver fur $2 per lb.; bears' skins $1.50 each; otters' skins $2 a piece; racoon 25 cents each; deers' skins 25 cents per lb. These prices were considered high by the purchaser, but they were only nominally so, for he paid them off in articles at the most exorbitant rates. Common three-point or Mackinaw blankets were sold at $8 each; butcher knives at $2; rifle locks at $8; common coarse blue cloth at $6 per yard; coffee at 75 cents per lb.; salt at $5 per bushel; lead at 25 cents per lb.; gunpowder at $2 per lb.; axes at $6 each; horse shoe nails at $3 per set, &c. The trade of this river is consequently attended with profits which amply repay for the risks and fatigues incident to a voyage in that quarter. Vast quantities of furs and skins are annually brought down this river, with some bees' wax, honey, beef, bacon, &c. and whenever the hunter population yields to the farming and mechanical class, the list of its productions will be swelled by corn, rye, wheat, oats, flax, hemp, and cotton; a sufficiency of each of which has already been raised, to show that the climate and soil are well adapted to their culture. Its mineral products may also claim our future attention. Iron ore, lead, zinc, and manganese, have already been discovered; and among its *earthy* minerals may be enumerated marble, flint, agate, jasper, hornstone, and rock crystal; specimens of which, with some others, I picked up during my journey there. Caves with

nitre are also common, and large forests of pine timber, which will be wanted in the progressing settlements on the Mississippi, are situated on its northern tributaries, and may be floated down at an inconsiderable expense.

White River runs in its whole length through a section of country, which according to a recent political division, belongs to the Territory of Arkansaw; but several of its tributaries originate in Missouri, the chief of which are James River, Great North Fork, or Pine River, and Black River, with its auxiliaries, Currents, Fourche à Thomas, Spring River, Eleven-points, and Strawberry River.

About one hundred and fifty miles below the Pawnee Mountains, the main south fork of White River is joined by the War Eagle, and Osage Forks, forming what is known among hunters as the *three forks* of White River, a region remarkable for the abundance of beaver found in its streams. In the course of the succeeding two hundred miles it is joined by King's River and Tower Creek on the south, and by the Waterbolt or Roaring Fork, and James River on the north, the latter being by far the largest stream it has thus far received, and contributing nearly as much water as all the others put together. From the mouth of James River to its junction with the Mississippi, it is successively joined by Long, Bull, Swan, Beaver, and Big Creeks, by the Little North Fork, the Great North Fork or Pine River, Black River, Bayou de Loutsho, and Cash River, on the north; and on the south by Bear Creek, Crooked Creek, Buffaloe Fork, and Little Red River; and it is finally connected with

the Arkansaw River by a natural canal called the *cut off*, about thirty miles above its junction with the Mississippi, and which affords a navigable water communication at all seasons. Many of the above tributaries are streams of no ordinary magnitude, and afford boat navigation for many hundred miles; and they are all characterized by strips of rich alluvial lands on their banks. James River, Buffaloe Fork, Great North Fork, Black River, and Little Red River, merit individual attention.

James River. This stream originates in highlands a few miles south of the Gasconade, in Missouri Territory, and after running in a southwest direction for two hundred miles, in the course of which it is swelled by Findley's River, and by other streams, forms a junction with White River one thousand miles above its mouth. Its waters have the purity of crystal; it lies under a climate the most mild, salubrious, and delightful; and on its banks are situated a body of the most fertile and beautiful lands which the whole valley of the Mississippi affords. The timber on its banks is abundant, a remark which cannot with justice be made of many parts of the adjacent country, and is remarkable for its size and its value, and nothing can exceed the vigour and the verdure of vegetable nature on this beautiful and neglected stream. Prairies are also found within a mile of its western banks, and extend towards the Grand Osage, as far as the eye can reach, level as a graduated plain, and waving with tall grass, on which the Elk,

the Buffaloe, and the Deer, feed in countless numbers.

Findley River forms a junction with this stream, near the centre of this choice body of land, and about one hundred miles above its mouth. Twenty miles above the junction of these streams, on the immediate banks of James River, are situated some valuable lead mines, which have been known to the Osage Indians, and to some White River hunters, for many years. The Indians have been in the habit of procuring lead for bullets at that place, by smelting the ore in a kind of furnace, made by digging a pit in the ground, and casing it, with some flat stones, placed so as to resemble the roof of a house inverted;—such is the richness of the ore, and the ease with which it melts. The ore has not, however, been properly explored, and it is impossible to say how extensive the beds or veins may prove. Some zinc, in the state of a sulphuret, is found accompanying it. There is not one inhabitant on all this stream; my own cabin, erected for a temporary purpose at the mines in January last, is the only human habitation within two hundred miles of that place.

Buffaloe Fork. This river originates near the north banks of the Arkansaw, and after traversing a rocky country for about one hundred and eighty miles in a northeast course, joins White River at the Buffaloe Shoals, about seven hundred miles above the Mississippi. It is a fine region for game, and affords some good lands.

Great North Fork, or Pine River. This is a stream of two hundred miles in length, and a hun-

dred yards wide at its mouth. Its waters are clear, being entirely made up of springs, which are numerous all along its banks, but the navigation is interrupted by rapids. It originates with James River and the Gasconade, in a ridge of high land, which throws a part of its waters into the Missouri, and a part into the Mississippi, the streams running in opposite directions. In travelling into that country, I accidentally arrived at the extreme head of this river, where it consists only of some drizzling springs, and pursued it down, in all its windings, to its junction with White River, about twelve miles below the mouth of Buffaloe Fork. It is bordered on both sides by limestone bluffs, covered generally with tall pines, and affording some detached strips of valuable land. On the whole, it must, however, be considered a sterile region, which will never admit of a dense population. The bottoms are overrun by cane, and brier, which render travelling extremely fatiguing.

This stream appears generally to have been considered by geographers as the head of White River, which is accordingly made to originate on most maps at this place. The error has been, in some degree, corrected in Robinson's new map of Louisiana, lately published at Natchez, which may be esteemed the best map extant respecting that section of country. He calls it *Pine River*.

Black River. This large, deep, and gentle river, is composed of numerous auxiliary streams, which draw their waters from the counties of Wayne, New-Madrid, and Lawrence, the two former lying in Missouri Territory, and the latter in Arkansaw.

It is navigable with boats of the largest burden, at all seasons of the year, for more than one hundred miles. Little Black, Currents, Fourche à Thomas, Eleven-points, Spring River, and Strawberry River, are all streams of considerable size, coming in on the west, and deserve particular notice on the future maps of that country. Their banks afford choice bodies of fertile lands, which are already the seat of many plantations and farms, where corn, rye, wheat, oats, flax, hemp, and cotton, are raised in the greatest perfection, and the settlements are rapidly increasing. Considerable quantities of beef and pork are also put up for the New-Orleans market, every facility being afforded by the luxuriance of grass in the woods, and the abundance of acorns in the fall, for raising and fattening hogs and cattle. Lawrence county is generally considered among the first farming districts, west of the Mississippi. Davidsonville, the seat of justice for this county, is situated on the west bank of Black River, at the junction of Spring River. The settlements on Strawberry River, on the Currents, Fourche à Thomas, Poke Bayou, and other places, are in a flourishing state of advance.

Little Red River. This stream issues near the sources of Buffalo Fork, and runs parallel with the Arkansaw for a great distance, but inclines gradually to the northeast, and joins White River, about two hundred miles above its mouth. It affords a considerable body of choice land, but is subject to very sudden rises, which overflow its banks,

and have retarded, in some degree, the further settlement of its valley.

Such are the principal tributaries of White River, a stream which is navigable with keel-boats of 50 tons burthen, to the foot of Buffaloe Shoals, a distance of seven hundred miles from its mouth, and may be ascended with light vessels five hundred miles higher. It draws its waters from a district of country about three hundred miles in width, by seven or eight hundred in length, having on its borders and tributaries large bodies of very rich lands, mixed with much that is poor and unfit for cultivation, but taking into view its advantageous situation for commerce, its political relation to the two territories in a part of each of which it lies, and the extensive bodies of farming lands on James River, Buffaloe Fork, and Black River, we may anticipate the period when a large population shall find their support on its banks—when numerous villages and towns shall decorate its banks and the productive labour of its inhabitants swell greatly the commerce of the westerncountry while they themselves command an important influence in its political transactions.

ARTICLE V.

MISCELLANEOUS INFORMATION.

SECTION I.

Hot Springs of Ouachitta, (Washitaw.)

THE attention of the traveller in the interior of Missouri and Arkansaw, is frequently arrested by the novelty of the scenery, and the wild and singularly fanciful aspect of the country; and he is often induced to stop to survey some cavern, waterfall, high loose-hanging cliff, or other natural phenomenon. But if the country be surveyed with a single eye to its natural curiosities, the Hot Springs of Washitaw will be found by far the most wonderful and interesting of any yet noticed.

These springs, which have been known for many years, are situated on a stream called Hot Spring Creek, which falls into the Washitaw River eight miles below. They lie fifty miles south of the Arkansaw River, in Clark county, territory of Arkansaw, (lately Missouri,) and six miles W. of the road from Cadron to Mount Prairie on Red River.

The approach to the Springs lies up the valley of the creek, which is partly made up of its waters. On leaving the banks of the Washitaw, the face of the country almost imperceptibly changes from a rich soil, covered with a luxuriant growth of trees, to a sterile mineral tract, and on coming near the springs, the traveller is presented with one of the most picturesque views of nature. On the right hand rises the Hot Mountain, with the springs issuing at its foot; on the left, the Cold Mountain, which is little more than a confused and mighty pile of stones, and the view in front is terminated by a high point of land, which makes down gradually into the valley, and separates the creek into two forks, of nearly equal size.

The Hot Mountain is about three hundred feet high, rising quite steep, and presenting occasionally ledges of rocks, and terminates at top in a confused mass of broken rocks, with here and there a pine or oak tree. Its sides, notwithstanding their sterility and the steepness of the ascent, are covered by a most luxuriant growth of vines, particularly *muscadine*, the fruit of which is delicious. Haws and blackberries are also found in great abundance.

The Cold Mountain is separated from the Hot, by a valley of about fifty yards wide, through which the creek flows, is nearly as steep as the other, about of an equal height, and terminates in the same confused manner. Some pine trees are found on it, but its side are destitute of vegetation.

The springs issue near the foot of the Hot Mountain, at an elevation of about ten feet above the level of the creek. They are very numerous all along the hill side, and the water, which runs in copious streams, is quite hot. It will scald the hand, and boil an egg hard in ten minutes. Its temperature is considered that of boiling water, but Doct. Andrews of Red River, tells me it cannot be reckoned over 200° of Fahrenheit. There is a solitary spring, situated seventy feet higher than the others, on the side of the mountain, but it is also of an equal temperature, and differs in no respect from those below. A dense fog continually hangs over the springs, and upon the side of the hill, which at a distance, looks like a number of furnaces in blast. It is this fog, which is water in the state of *vapour*, which is probably condensed by the cold air at night, and produces such a rank growth of vines on the side of the mountain, where otherwise there would hardly exist a sign of vegetable life.

An idea of the beneficial effects of this water is generally prevalent throughout the territory, and numbers annually resort to the springs. They are thought serviceable in rheumatisms, ulcers, sore-eyes, dropsy, and pains in the breast: and are said to prove efficacious in all chronic com-

plaints. The method of using the water is various. Bathing and sweating, are generally resorted to. It is also drank as hot as can be borne, and is not productive of nausea in the stomach, like common warm water. Of the chymical or medicinal properties of the water, little is known. An analysis is said to have been made, which indicated a little *carbonat of lime.* The water looks extremely clear, pure, and beautiful, and the substances which are united with it, (if any besides *caloric* and *lime*,) are held in solution, for it deposits no sediment by standing.

There is abundance of a beautiful green *moss* growing in the springs, near the edges, and their devious courses to the creek below, are only indicated by a more vigorous growth of grass and moss all along the borders, and a *brighter green.* That warm water is a most stimulating food for plants has been frequently asserted. A satisfactory evidence is here afforded of it.

The mineralogical character of the country around the springs, is highly interesting. Three miles above, is a quarry of oil-stone, (*novaculite*,) of the most valuable kind. The stone has a very compact texture, is heavy, translucent, and gives a fine edge to a razor, &c. It is considered equal to those imported from *Turkey.* The rock formations here, are limestone, slate, and quartz. Veins of white quartz are found running through the slate rock four or five feet wide, and detached pieces of it, beautifully crystallized, (*rock-crystal*,) are found in plenty in the neighbourhood of the springs. A vein of singular earth, a

kind of *lithomarge*, is also found at the springs. It is soft, like clay, of a soponaceous feel, and of a texture so delicately fine, that it feels to the touch like satin. It would probably operate as a detergent to the oily particles of newly woven cloth, and in this respect answer the purposes of *fuller's earth.*

At the *Cove* on Washitaw River, fifteen miles below the springs, there is a body of loadstone, also white, and blue vitriol, iron ores, and mica. Unmagnetical pyrites of iron, of a brass-yellow colour, and crsytallized in cubes, is also the product of that neighbourhood; and there is a stone, which on burning and exposure to the air, yields a saline substance, of the nature of Glauber's salts.

The Hot Springs are situated on public land, which is only valuable on account of the springs, and such minerals as may exist in that quarter. It is too sterile for farming. A New-Madrid claim has been lately laid upon them, by colonels Hammond and Rector, of St. Louis, and by some others. so that the title is in dispute. They are destined to become a place of great resort,—*the Ballston of the south.*

SECTION II.

List of steam boats on the Mississippi and its tributary streams. (1819.)

No.	*Names.*	*Tonnage.*
1.	Etna	200,
2.	Vesuvius	280,
3.	Orleans	200,
4.	Alabama	300,
5.	Columbus	400,
6.	Tamerlane	200,
7.	James Ross	250,
8.	United States	500,
9.	Paragon	250,
10.	Thos. Jefferson	200,
11.	Ohio	300,
12.	Gen. Jackson	100,
13.	Maysville	152,
14.	Exchange	154,
15.	Volcano	140,
16.	Madison	100,
17.	Kentucky	60,
18.	Hecla	100,
19.	Napoleon	200,
20.	Washington	150,
21.	Buffaloe	100,
22.	James Monroe	70,
23.	Cincinnati	85,
24.	St. Louis	200,
25.	General Pike	75,
26.	Independence	100,
27.	St. Louis Packet	150,
28.	Ramapo	100,
29.	Rising States	150,
30.	Maid of Orleans	100,
31.	Hamlet	100,
32.	Perseverance	50,
33.	Johnson	75,
34.	Eagle	100,
35.	Vesta	110,
36.	Harriet	40,
37.	Constitution	45,
38.	Louisiana	60,
39.	Gov. Shelby	60,
40.	Franklin	80, (sunk)
41.	Rifleman	60,
42.	Newport	45,
43.	Expedition	150,
44.	General Clark	150,
45.	Henderson	150,
46.	Tornado	250,
47.	Elizabeth	175,
48.	Missouri Packet	100,
49.	Post Boy (for passengers only)	
50.	West. Engineer	40.
		7,306 Tons.

In addition to this, there are two new boats building at Pittsburgh, one at Wheeling, one at Steubenville, one at Marietta, two at Cincinnati, one at Frankford, two at Shippingport, one at Madison, and two at New Albany, making a total number of sixty-three. There are also several more in contemplation, so that it is probable another year will considerably augment the number. The first steam boat on the western waters, was built at Pittsburgh in 1811, eight years ago. Hence it appears there has been an average increase of eight boats per annum; but by far the greatest proportion have been built within the last three years.

7306 Tons at 4 cents per lb. *freight up* from New-Orleans, amounts to	$584,480.00
7,306 Tons at 1 cent per lb. *freight down* to New-Orleans	146,120.00
10 passengers down in each boat at $60	39,800.00
5 do. up in each boat at $100	31,500.00
	$801,900.00

It is presumable that each boat will perform three trips to and from New-Orleans per annum; which will make an aggregate amount of freight and passage money of $2,405,700.00 per annum. From this some idea of the trade, population, and business of the vast valley of the Mississippi may be formed. And let it be remembered at the same time, that the transportation of merchandise is not wholly done by steam boats. The Ohio and Mississippi are still lined with keel boats and

barges, and much of the produce is still carried to market in *flat-bottomed boats*, of a temporary construction, which are not calculated to ascend the stream, and are generally sold for a trifle, or abandoned.

The following is extracted from a comparative statement of the increase of the principal articles of produce, which have come to the New-Orleans market for a period of three years.

Productions.	1815.	1816.	1817.
Bacon & Hams, cwt.	7000	13,000	18,000
Butter, lbs.	——	500	1,800
Cotton, bales	60,000	65,000	65,000
Corn, bushels	120,000	130,000	140,000
Flour, barrels	75,000	98,000	190,000
Molasses, gallons	500,000	800,000	1,000,000
Pork, barrels	8,000	9,700	22,000
Sugar, hhds.	5,000	7,300	28,000
Taffia, gallons	150,000	300,000	400,000
Tobacco, hhds.	5,000	7,800	28,000
Wheat, bushels	——	——	95,000
Whiskey, gallons	150,000	230,000	250,000

SECTION III.

Precious Stones of Missouri.

Ascending the Mississippi River with a particular view to the mineralogical character of the country, I have been enabled to detect several minerals of a rare and useful kind, which a less at-

tentive observer may have passed unnoticed; and among them, *carnelian*, *jasper*, and *opal*, may be particularly mentioned.

Several specimens of these gems, now before me, were found on the banks of the Mississippi, at the Grand Tower, Herculaneum, and St. Louis; and for transparency, hardness, and riches of colour, are only excelled by the finest oriental specimens.

The avidity with which they are sought by lapidaries, and the high value set upon them from the remotest antiquity, and by all nations, gives the subject additional importance, and may render some further particulars acceptable. The traffic in those articles has been almost wholly confined to Europe, Asia, and Africa, while the new world has been considered destitute of them. At least, but few traces of them have been discovered in North America, and none have heretofore been afforded by the United States. But the more we examine into the mineral character of our country, the more interesting is it found, and every year is adding some new item to the catalogue of useful minerals. Hence the opinion is imperceptibly acquiring strength, that it is the neglect which this department of science has experienced, (and not the poverty of our streams and mountains) that has heretofore prevented us from setting a proper estimate upon the mineral resources of our diversified and extensive country.

1. *Carnelian*. Of this stone I have eleven specimens. The colour of the first *five* is blood-red, intermingled with flesh-red, and honey yellow.

and exhibiting altogether a clouded appearance. They are transparent in a considerable degree, possess much lustre, and so hard as not to be scratched by the file; nor does the nitric or muriatic acid affect them in the least. The several pieces are in the shape of detached lumps of an elliptical figure; or fragments of no determinate shape, possessing a smooth conchoidal fracture. The sixth specimen is globular, of a clear honey yellow, intermixed on one side with dark red spots, and on the other presenting two sections of a circle joined at their opposite extremities, and composed of concentric lamina of a reddish hue, giving the whole, when held up to the light, an appearance of singular beauty. The other five specimens are of an uniform smoke-brown colour, and possess considerable transparency.

2. *Jasper.* A specimen of this now before me, is the fragment of a nodule or oviform piece which has been broken nearly through its centre longitudinally. The fracture is smooth conchoidal. It is perfectly opaque, and shining, and consists of concentric layers of olive green, alternating with yellowish-brown. Another specimen is flesh and rose-red, in alternate stripes; and a third is striped blue and white.

3. *Opal.* Of this rare stone I have only succeeded in procuring one specimen; it is, however, one of incomparable beauty. The colour is such a compound of blue, yellow, and white, as characterizes the richest oriental specimens; neither can be said to predominate, but are so blended as

to present a changeable hue when held in different directions to the light. The lustre is pearly: in transparency it is *opalescent*. The outside is rough, and has a vitreous appearance.

In addition to these, it may be mentioned that some stones of great lustre, transparency and hardness, and of a rich uniform yellow colour, are also found, and which appear to me to partake of the character of the *Brazilian topaz*. The Mississippi also affords tabular pieces of a silicious stone, so colourless and transparent, that they would probably be considered as *Scotch pebble* by the lapidaries. Of both of these, I possess numerous specimens.

These stones are all brought down the Mississippi during the spring floods, when the water runs with the utmost velocity, and are washed up on those sand bars, islands, and beaches of the river, against which the current sets the strongest. Of their original situation, we can only form conjectures. They are probably afforded by one of the head streams of the Mississippi. The Missouri is not characterised by them, and they are reported to be in greater plenty above than below its junction with the Mississippi. Rock River and the River Desmoines, are said to be characterised by a singular variety of stones and rocks, and may probably be the sources from which these fragments have been carried down. Desmoines enters the Mississippi, two hundred and thirty-three miles above St. Louis, and Rock River, three hundred and ninety miles, which is about one hundred and

twenty-seven miles below the lead mines of Prairie Du Chien.

SECTION IV.

Manganese.

"This useful mineral has recently been discovered on Big Sandy River, in the vicinity of Greenupsburg, Kentucky, where it is said to exist in great abundance, and judging from the external character of a sample in my possession, I am led to think it is of a quality no way inferior to that of foreign production.

"Manganese is a heavy black, metallic substance, resembling in the more perfect specimens *cast iron*, and soiling the fingers like soot. It is employed in the arts by the bleacher, potter, and glass-maker, and for the purpose of experiment in the laboratory of the chymist. By the bleacher it is used in the preparation of *oxy-muriatic acid*, according to the method of bleaching now universally pursued. By the potter it is employed in communicating a *black* glazing to the ware. By the glass-maker for depriving his compositions of the green hue given by iron, and *occasionally* as a colouring ingredient: and by the chymist, for procuring *oxygen gas*, which substance it yields in great abundance. Its importance as an item in the catalogue of useful minerals afforded by the United States, is therefore considerable; and it

may be regarded as an advantageous discovery in a country which has hitherto been supplied with this article, exclusively by Great Britain, imported either directly from the island of Britain, or from her dependencies in Nova Scotia."

The above was originally inserted in the Kentucky Herald, a paper printed at Louisville, under the signature of "A Traveller." Manganese is also found on the Merrimack River, in Missouri; at Bennington, Barre, and Monckton, in Vermont; and at Franconia in New-Hampshire. That on the Merrimack, is a discovery I made last fall, (1818,) on a tour into the interior of Missouri. It lies in vast quantity, about forty miles southwest of Potosi, on the Indian trace to the Gasconade and Osage; and accompanied by ores of iron. I have also met with a body of manganese, on the dividing ridge between Eleven-points, and Fourche à Thomas, two streams running into Black River.

In addition to the uses of manganese already enumerated, it may be mentioned, that it is employed in small quantity in the manufacture of *enamels* and *artificial gems* or *pastes.* It is an ingredient in that kind of mortar or cement, which is intended to stand under water, as in the construction of light houses, cisterns, canals, &c. It is employed as a pigment, both for painting upon wood and glass, and has some uses in the farrier's art. In glass-making it is of the highest importance; without it, hardly a piece of good crystal glass could be made, and it has been employed in this art from the earliest time. It is known to have been used before the commencement of the Christian era, and long before its peculiar nature was under-

stood. Its ancient name of *glass-soap* still conveys an idea of its particular use, which is to deprive the glass of any accidental foulness of colour. If all the materials of glass could be prepared in a state of *absolute* purity, and then melted without coming in contact with smoke or any other carbonaceous matter, manganese would be unnecessary. But this, however easy in a chymical experiment, is impracticable in a manufactory in the large way. If the materials were all pure, they would melt colourless, there would be no need of manganese to rectify the colour; but to obtain this purity would cost a greater sum, than the article would sell for when made. When, therefore, every precaution has been taken in the preparation and purification of the materials the last portions of iron must be got rid of by a small dose of manganese. This possesses the property of discharging the green hue which glass acquires from iron—from the iron which is chymically combined in the state of an oxyd with the sand, the potash, and every other ingredient employed. When the dose of manganese is too great, it communicates a violet tinge to the glass; if more be added, the colour is full and rich, and if an excess be employed, it turns black and opaque from the intensity of colour. If the quantity taken be too little, a greenish hue will be remaining in the glass; and it requires a skill and nicety in the proportioning this ingredient, which is only to be acquired by practice. Regard must constantly be had to the purity of the materials used, and the *varying degrees of purity* from day to day, according as good or bad sand or alkali be

employed, or as a defect in the preparation is observable, so that it is a subject requiring the constant attention of the glass-maker, and no invariable, rule applicable to all times and situations, can be given. The common dose to a pot of flint-glass, is three ounces, but this indicates the materials in a state of considerable purity. The construction of the furnace, the kind of wood or other fuel employed, and other circumstances, have also a prodigious effect in varying the result of the same composition. That which will melt well and produce an article of excellent quality, at a furnace, which in the technical phrase *runs hot*, may produce a very defective ware, at another, where a less intense degree of heat is given, or less skill has been manifested in the smelting. It is not alone in the excellency of a receipt, that the art of making glass consists, it is necessary also that the *art of melting* be understood; and there is full as much skill required in the latter, as in the former: and I believe artists oftener fail from inattention to melting of glass, than from a defect in their compositions. For the receipts, although various, are generally good,—they do not prepare the materials with sufficient purity—they do not compound them with sufficient precision—and above all, they do not melt them with sufficient skill. To excel in melting, requires a well constructed furnace, one built of the best materials put together in the best manner; and a good furnace is of little use, without refractory melting pots, and both these must fall short of success, if not heated by the best fuel—by the best wood, well dried, or the

strongest inflammable stone-coal. Hence the necessity of an unremitted attention to these subjects, —of a knowledge of the principles of the different substances employed—of precision in the practice —of skill in the theory. Hence the importance of chymical, as well as mineralogical knowledge. For an artist who is continually operating with alkalies, salts, clays, sands, &c., should be perfectly conversant with their nature, properties, and affinities; the changes they undergo by mixture with each other, by exposure to heat, air, light, and under every other situation in which they are capable of being placed. To a want of this information, we may attribute the complaints which have been so universal against American glass. But we are growing wise, and shall, by and by, consider a man a better artist, for having had a better education.

Manganese has not been classed as a peculiar metal over forty years. It was formerly considered as an ore of iron. In the state in which we see it in commerce, it is the *oxyd of manganese* of chymistry. On exposure to a high heat, in a close crucible, with charcoal, it is reduced to a metallic state.

SECTION V.

Antique Silver Cup.

There is now in the possession of Mr. Samuel Hill, of St. Clair county, Illinois, a silver cup which was taken from one of the mounds at Marietta, on the Ohio.

In a tour lately made through that country, I paid a visit to Mr. Hill, at his house, near Cahokia, and had an opportunity to examine the cup. It is in the form of an inverted cone, measuring three and a half inches across at top, two and a half at bottom, and four inches in height. It appears to be of pure silver, and so skilfully wrought that no traces of the plating hammer are discernible. The bottom, which is circular, has been separately forged, accurately fitted to the sides or barrel of the cup, and soldered in, and the line of attachment is plainly observable. Its interior surface has been gilt, or washed with a bright yellow untarnishable metal, which is undoubtedly gold; but the gilding is impaired in some places, and the vessel appears to have been considerably used.

I am further enabled to state, from a conversation with Mr. Hill, that the cup was found in a mound at Marietta, half a mile east of those remarkable ancient fortifications on the Muskingum, which have attracted the notice and the wonder of travellers since the earliest settlement of the country. The mound is situated on a woody plain, with a gentle declivity towards the river, and a

small stream washes its base; and during the autumnal rains, or the melting of the snow in spring, runs with the velocity of a torrent. Thus it has gradually washed away the earth, and laid open the mound for a considerable space, and in this situation the cup was noticed by the discoverer. It was then in a bruised and shapeless mass, and foul from adhering clay, &c.; but being taken to a silversmith, was put into the shape it now presents, which is probably the shape it originally had. Its value, by weight, at this time, is about $15. It bears no device, or ornamental work of any kind, being a perfectly plain, heavy piece of workmanship.

It is impossible to view this relic of antiquity without feeling the strongest interest in the subject, and an irresistible desire to know by what nation or tribe of people it was fabricated; at what period of the world, and why they have become extinct, or abandoned the country, without leaving any other traces of their history, but what are to be drawn from mounds, fortifications, and other analagous relics, which are every day found in the path of the emigrant and traveller. But we must wait till facts accumulate, before the mystery can be unravelled. We cannot, however, contemplate the present discovery, without admitting the conclusion, that whoever were the manufacturers of this vessel, and whatever the epoch to which we refer its origin, they certainly possessed a greater skill and knowledge of mining, minerals, and mechanic arts, than any of the savage tribes who inhabit-

ed the country when first visited by Columbus, Americus, Cortez, Cabot, Hudson, or La Salle. It is not supposed that the Mexicans, however advanced towards refinement, when conquered by Cortez, possessed the skill in working silver, which is indicated by the Marietta cup. Neither do any of the savage tribes at the present day, after an intercourse and acquaintance of nearly 300 years with Europeans, possess the ordinary skill of the silversmith, plater, or refiner.

SECTION VI.

Lead Mines of Millersburgh, Kentucky.

These mines are situated 28 miles north of Lexington, on the main road leading to Maysville. They lie in the town of Millersburgh, Bourbon county, and 8 miles north of Paris, the county seat.

They were discovered in the year 1799, in an extraordinary manner. A farmer standing on an eminence, overlooking a cornfield on the plantation of Maj. Miller, observed the stalks in commotion, produced by the trembling of the earth in that place, which continued to increase until the earth exploded; when the farmer, terrified with fear, ran home. Some days afterwards, ploughing in the same field, he turned up a lump of lead ore with the plough, and this gave the hint for making a search. On digging, a large body of

ore was struck at no great depth; and a number of discoveries have since been made in that neighbourhood, the principal of which is Elliot's mine. I should hesitate to mention the extraordinary phenomenon attending this discovery, were it not authorized by the most respectable and intelligent persons of that neighbourhood.

The effects of the explosion were discernible for two miles in a particular direction, which is that of the vein of lead ore, as was found by sinking in various places upon it. Mr. Elliot sunk a shaft 40 feet deep in pursuit of the vein of ore, and in that distance there was a gradual increase in its size, and it was left when the vein was the largest, and the prospect of arriving at a body of ore, the most flattering.

The ore found in this vein was imbedded in white quartz, pervading a rock of hard blue limestone, which underwent a decomposition on exposure to the air and weather. The ore, when well cleaned, often produced 75 per cent. in the large way; and Mr. Elliott, who has since carried on the mining business in Washington county, (Missouri,) tells me he considers the prospect more flattering at that place, than at any mine he has seen west of the Mississippi. Not that there is a greater body of ore in view, or that the district of lead ore is any wise so extensive; but such prospects as do exist are of a character entirely to be depended upon; and such as, if the vein was followed up, would more certainly lead to a large body of ore. He thinks it would justify the expenditure of a considerable sum in digging and ex-

ploring; that to do it effectually, such a sum would be required, and that such an expenditure would undoubtedly lead to an invaluable discovery of ore.

These mines were worked under the authority of a lease from Maj. Miller, proprietor of the soil.

SECTION VII.

Antique Glasses, discovered in Hamburgh, Niagara County, New-York.

"An opinion is entertained by many well informed persons in the United States, that the country has, at some remote period, been inhabited by a civilized people, prior to its settlement or subjugation by the savages: and to the many evidences furnished to strengthen the opinion by the remains of fortifications, tumuli, &c. may be added the discovery of a number of pieces of glass, of singular workmanship, lately made in Hamburgh, Niagara County.

"I have been favoured with an opportunity to examine one of these glasses, and on the authority of my informant am enabled to remark, that they were taken up about two months ago from an ancient barrow in the town of Hamburgh, where they were found deposited in an earthen pot. Contiguous to this pot were also found a skull, and some other bones of the human frame, of an unusual size. This mound, or supposed repository of the dead, is

situated in an uncultivated part of the town, and several trees were growing upon it at the time the excavation was made; some of which were judged to be upwards of two feet in diameter.

"The glass which I had an opportunity to examine, (and I am informed they are all alike,) is in the form of a large barrel-shaped bead; consisting of a tube of transparent green glass, covered with an opaque coarse red enamel. Its length 9 tenths of an inch; its greatest width 6 1-2 tenths of an inch; and the bore of the tube 2 tenths of an inch. Near the circle of the bore of this tube is an aperture of the size of a large needle, perforating the tube from one end to the other. The enamel which covers the tube of transparent glass, appears to have been ornamented with painting, in figures resembling a spindle, or two inverted sections of a circle; but they are now hardly perceptible, as the bead appears to have been considerably worn.

"But the circumstance most indicative of art in the making of this bead, is a species of enamelling which has been performed both on the external and internal surfaces of the tube, previous to its being covered by the coarse red enamel. This second enamel is white, and as the external surface of the tube was not smooth, but in parrallel *strie* or veins, exhibits the appearance of a white vine between the green tube and the red enamel. This enamelling appears to me to have been done, not by melting on any vitreous composition, as is practised at the present day, but by the effect of calcination for some time in a low red heat. This, it is known, will deprive glass, especially *green*

glass, of its transparency; and render the surface white to a certain depth.

"The composition of the tube of glass, I have judged to be simply a silicious sand and an alkali; probably with a small addition of lime or vegetable ashes. It is hard, and will not receive scratches like the lead glasses, and I conclude from this circumstance that there is no lead in the composition. Its colour seems also owing to the impurity of the materials employed, like the common window and bottle glass; and is probably caused by a minute portion of iron in the state of an *oxyd*, combined with the sand and alkali.

"The red enamel covering the tube, and the pot in which these glasses were found, seem to have been constructed of similar materials, as they differ very little in colour, texture, or other external character. Probably a very fusible brick clay, highly impregnated with the oxyd of iron, and pulverized fragments of green glass, are the principal ingredients of both. The earthen pot is manifestly constructed of different materials from those employed for brown pottery at the present period. It is a more imperishable substance, of a close texture, and vitreous appearance.

"I shall not presume to speculate in opinions which discoveries of this interesting nature are calculated to create; it may, however, here be added, that the fabrication of these glasses would suppose a perfection in the arts which none of the Indian tribes inhabiting this country at the period of its discovery, had arrived to. That if introduced by the French from Canada, in their earliest com-

munications with the Indians inhabiting the western parts of this State, a sufficient time would hardly have elapsed for the growth of trees of such size as were found upon the mound from which these relics were taken. And that if not introduced by the French at the period alluded to, we must refer their manufacture back to a very remote date, and one on which Indian tradition is wholly silent."

The above was originally printed in the Utica Patriot (Sept. 1817,) under a fictitious signature. Since visiting the western country, I have had occasion to notice a similar discovery on Big River, in the Territory of Missouri. On opening an Indian grave (or what is considered such) on the banks of this river, several beads of glass, of a similar nature, were found. They were accompanied by many bones of the human frame, of a most extraordinary size, and which indicated a stature eight feet in height. The person appeared to have been deformed, either by birth or through accident; the right jaw bone running in a straight line from the mouth back, while the left preserved the usual curve.

This excavation was made near the banks of the river, where the soil is a rich alluvion, and covered by a heavy growth of forest trees, such as are peculiar to the richest Ohio and Mississippi bottom lands.

SECTION VIII.

Dwarf Skeletons.

From the Missouri Gazette of November 6, 1818.

A SHORT time since, Mr. Long, the proprietor of a farm on the south side of the Merrimack River, about fifteen miles from this place, (St. Louis) discovered on the scite on which he had fixed his dwelling, a number of graves, the size of which appeared uncommonly small. This awakened his curiosity, and led him to a minute examination, which convinced him they were the remains of human beings much smaller than those of the present day. He seemed warranted in this conclusion, as well from the uniform appearance of the skeletons, (the length of which in no case exceeded four feet) as from the teeth, which bore the evident marks of those belonging to adult persons. He communicated these facts to a gentleman of this place, who on Sunday last, together with two other gentlemen, accompanied by Doctors Walker and Grayson, proceeded to the place of interment. They found, as had been stated, in a wood adjacent to the house, a great number of graves, all situated on small tumuli or hillocks, raised about three feet above the surface; they examined several, the first of which by actual measurement was discovered to be only twenty-three inches in length. The grave was carefully cased up on both sides, as well as at the head and foot with flat stones; in

the bottom also a stone was fixed, on which the body was lying, placed on the right side with the head to the east. Time had completely destroyed all the soft parts of the body, as well as decomposed the bones, which, however, still preserved their relative situation. The teeth, which were expected to furnish the best, and perhaps only *data* to judge, were found in a state almost perfect, being defended by the enamel, which seems only to yield to chemical decomposition. To the astonishment of all, they proved to be the teeth of a being, who, if it had not attained the age of puberty, had unquestionably arrived at that period of life when the milk teeth yield to the second or permanent set. The *molares* and *incisores* were of the ordinary size of second teeth. The jaw bone seemed to have its full complement, unless it was the *dentis sapienta*, or what is better understood by the wisdom teeth, which make their appearance from the age of eighteen to twenty-two or twenty-three. The next grave examined was on an adjacent mound, and measured twenty-seven inches; it resembled in every respect the first, except that the top of it was covered with flat stones placed horizontally. Several others were opened, all of which presented a uniform appearance; and none, although many were measured, proved to be in length more than four feet two or three inches.

From these facts the mind is brought to the irresistible conclusion, that these are the remains of beings differing altogether from, and inferior in general size, to ourselves.

For if in the subject first mentioned we suppose it to be a being of the usual growth, the facts of its having attained the age of seven or eight years, as seems proven from the teeth, is directly opposite to, and at war with, the circumstance of its being only twenty-three inches long, the usual length of a child eight or ten months old, and justifies the conclusion that by nature it was destined to be of inferior size. As to the time these bodies have been deposited, there is no clue by which to form any certain opinion. The bones have been thoroughly changed by time, nothing remaining but the lime or earthy particles of them, which can undergo no further change, and may as well be supposed to have been in this state five centuries ago as one. It is certain they have been there an immense length of time, from the large growth of timber on the mounds, and the roots of trees which have made their way through the graves.

The subject certainly invites the attention of the learned and curious, and opens an ample field for investigation, at least to form some plausible conjecture of a race of beings who have inhabited our country at a period far beyond that of which tradition gives us any account.

The following remarks on the same subject from the pen of Rufus Pittibone, Esq. of St. Louis, appeared in the same paper in February ensuing:

" A publication in your paper of the sixth of November last, concerning a discovery of some dwarf skeletons, made upon the farm of a Mr. Long, on the north bank of the Merrimack River, in this

county, (St. Louis) together with several letters from this place, on the same subject, are now going the round of the American papers. As yet, I have seen no attempt to account for the size and appearance of those skeletons, upon any other supposition than that they are the remains of a people far less in size than any known at the present day. Unwilling to adopt a belief so contrary to the general order of nature and to the history of the human species, so far as it has been transmitted to us, I shall hazard some conjectures upon the subject, which I think will, in some measure, tend to dissolve the mystery that hovers over these bones, and to reconcile their appearance with the general history of our race. To be sure, Nature, in her sport, has now and then produced monsters. A taste for the marvellous among travellers and historians, has occasionally conjured up a race of giants, or a nation of pigmies; but when the light of truth has reached us from the distant corners of the earth where they were said to dwell, we have found them to assume the size, shape, and attitude of men, and nothing more. So far as observation or history extends, we find the species nearly the same in all ages and in all countries. Climate has had some effect upon the size and upon the complexion. The excessive cold of the north has shortened an inch or two the necks of the Esquimaux, and the heat of the south has coloured the African. But what in this genial climate should make dwarfs? It is here, if any where, that we should naturally expect to find giants! All the other productions of nature are

here brought forth in the highest perfection. And shall *man* here grow a pigmy? Unless we are ready to adopt the opinion of certain naturalists, that the human species are the legitimate descendants of the apes, and that they once wore tails, and were of their diminutive size,—unless we are ready to believe the history of the Lilliputians, and of Tom Thumb, I think we shall discard the idea of a nation of dwarfs, as wholly preposterous. But how shall we account for the appearances upon the farm of Mr. Long, upon any other supposition?

"None of the graves found there exceed four feet in length, many of them fall short of three, and the teeth found in all of them show that they contain the remains of human beings who had arrived at years of maturity. The manners and customs of the Indians with respect to the treatment of their dead, will, I think, solve all difficulties; and satisfactorily account for these appearances, without doing violence to nature. According to the testimonies of travellers and historians, it has been the custom among many tribes of Indians, to hang their dead in baskets upon trees, and upon scaffolds, until their flesh was consumed, and then to take them down, and clean their bones, and bury them. There existed an order of men among them called *bone-pickers*, with long nails like claws, whose business and profession it was to clean the unconsumed flesh from the bones, previous to burial. This custom still exists among the Indians on the waters of the Missouri, and rationally accounts for the appearances upon the farm of

Mr. Long. The bones of a skeleton of the ordinary size when separated, would naturally occupy a grave of three or four feet in length It appears that in all the graves which were opened, the bones, except the teeth, were reduced to a chalky substance, so that it would be impossible to know, with any certainty, in what state, condition, or form they were deposited there. These skeletons are said to rest on their sides. Taking this fact to be true, it goes to strengthen my ideas on this subject. In burying a corpse it is natural, and so far as we are acquainted, universally the custom, to bury them with the face upwards. We can look upon our dead friends with a melancholy complacency,—we cast a long and lingering look after them until they are completely shut from our view in the grave; and nothing is more hard and heart-rending than to tear our last looks from them. It is natural then that the body should be placed in such a position as most to favour this almost universal desire of the human heart. But in burying a skeleton, it would be as natural to avert the horrid grin of a death's head from us. To face the grinning skeleton of a friend must fill us with horror and disgust. 'Turn away the horrid sight,' would be the language of nature. If we adopt my supposition, as correct in this case, all the facts correspond with nature. But if we adopt the opinion of the writer in your paper, our opinions are at war with nature, reason, and universal observation."

The following observations by the Rev. J. M. Peck, of St. Louis, may also here be added.

" A communication in the Gazette of the 10th instant, by "Historicus," accounting in a rational manner for the graves on the plantation of Mr. Long, has given rise to the following remarks, as tending to cast further light on the subject, and in part confirm the opinion of the writer:

Mr. M——, informed me, that himself, his lady, and another, were present at the opening of several graves, after the spot had been visited, and the skeletons examined by several physicians of St. Louis. One grave was opened which measured four feet in length; this was formed by laying a flat stone at the bottom, placing one on each side, one at each end, and covering the mouth with another. In the last circumstance, this grave differed from the others that were opened, the contents were a *full grown skeleton*, with the head and teeth, part of the spine, the thigh and leg bones, in a tolerable state of preservation The leg bones were found *parallel with the bones of the thighs*, and every appearance indicated either that the corpse had been entombed, with the legs and thighs placed so as to meet, or that a skeleton had been deposited in this order. The first opinion seems the most probable, from the fact that a *large stone pipe* was found in the tomb, and which I understand is now in the possession of Mr. Long.

It is a well known fact. that both implements of war, and of domestic use, are buried with the dead bodies of the Indians, but it admits of a query, if they are ever *deposited with the mere skeleton.*

" It is a well known fact," says bishop Madison, while writing on the supposed fortifications of the

western county*, " that among many of the Indian tribes the bones of the diseased, are annually collected and deposited in one place, the funeral rites are then solemnized with the warmest expressions of love and friendship, and that this untutored race, urged by the feelings of nature, consign to the bosom of the earth, along with the remains of their diseased relatives, food, weapons of war, and often those articles they possessed, and most highly valued when alive." This fact is substantiated from various respectable sources. The pious custom of collecting the relics of the dead, which accident, or the events of a battle, might have dispersed through the wilderness, easily accounts for the graves on the Merrimack, as well as explains the origin of the artificial *mounds* in our vicinity. If these were opened, there would be found promiscuously deposited the bones of the aborigines, which pious veneration from year to year, and from century to century, industriously collected. The cemetery alluded to on the plantation of Mr. Long, may be viewed as the public burial place of some powerful nation of the *same size*, and similar customs with other Indians.

No wish is entertained to object to the hypothesis of "Historicus," in regard to the customs to which he alludes. The shortness of the graves may be attributed to different causes."

On the preceding information, it may be observed, that however ingenious and forcible the reflec-

* *See American Philosophical Transactions, Vol. vi.*

tions appear, which have been advanced by Mr. Pettibone, and Mr. Peck, in opposition to the prevalent opinion of the dwarfish origin of the Merrimack bones, their remarks cannot, however, be considered as conclusive. Undoubtedly those customs, to which allusion has been made, were were formerly prevalent among many of the savage tribes of North America, and may still be practised in the remote and uncultivated regions of the west, but it is difficult to bring the mind to the conclusion, that a person arrived at the age of maturity, of the common stature of the human race at the present day, and whose bones had been interred several centuries ago, but still preserve their *relative situation*, should measure only four feet in length, while the teeth and the bones in several of the graves opened in the presence of doctors Walker and Grayson, indicated a child arrived at the age of eight or nine years, and whose stature could not have exceeded twenty-three inches. Where is the child of the present day, arrived at eight or nine years of age, whose height will not exceed this, by at least a foot? Nor is the circumstance of the relative anatomical situation which was observed to exist among these bones, by any means reconcileable with the supposition of the interment only of the osseous parts of the body, which would probably be thrown together without the exercise of that knowledge in anatomy, which is requisite in putting joint to joint, and bone to bone, in the manner they were created.

We must therefore hesitate in receiving conclusions which are not founded on physical observation, or drawn from facts too evident to admit of

contradiction, but on the contrary, there is much to favour the opinion that they are the relics of a race of beings inferior in stature to ourselves. Who they were—whither fled—why created, or destroyed? are inquiries which do not admit of being satisfactorily answered. Our knowledge of the ancient history of the land we inhabit, is very little. A few detached facts, some traditions and surmises, drawn rather from the probability of things than the discovery of facts, is all we possess. A beginning only has been made. Of our antiquities we know nothing. Every year is bringing to light some fresh relic of ancient use, folly or splendour, and all tending to show that our country has been inhabited by a people conversant with the arts, if not the refinements of civilized life. Our mounds, tumuli, embankments, and ancient fortifications, are subjects replete with the highest interest, and presenting an ample field for philosophical speculation and inquiry. Connected with this subject are the *Merrimack bones, the silver cup of Marietta, and the glass beads of Niagara.* But we must wait till additional facts are collected and compared, before we can form a conclusive theory. We cannot reason surely from the inspection of one detached point; we must view our whole country in connexion, not only as regards the order of time, but its geographical position, its soil and climate, its geological structure, and the physical changes it has undergone since the creation of man—the cycles of excessive heat, or excessive cold, to whose influence it has been submitted, in the lapse of centuries,—these and

other analogous matters, must be considered in contemplating its ancient history. But these are not the efforts of a day, nor the works of an individual; time must be consumed, exertions must be made, difficulties must be encountered, and prejudices overcome; and the collective energies of a Society are necessary to accomplish so desirable an end,—to collect, compare, and apply accumulating facts,—to embody and spread them—to assist the studious in the pursuit of further knowledge—to point the methods of procedure—and finally, to encourage the enterprising, and to reward the successful. When such efforts are made, we shall know more of the history of our land, and of ourselves; and the light of antiquity will shine upon our neglected mounds and fortifications, with a splendour that shall vie with the walls of Babylon, and the ruins of Herculaneum.

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FINIS.